

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. XVI

JUNE, 1931

No. 6

RADIOLOGY AS A CAREER¹

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THE statement is often made that the practice of medicine is both an art and a science. This statement is true in varying degrees in the fields both of diagnosis and treatment. In the field of diagnosis the art of medicine is concerned with the collection of data; the science of medicine with the systematic arrangement, correlation, and evaluation of such data. In the field of therapy the art of medicine covers all those technical procedures, now almost innumerable, in the treatment of disease; but there is also a science of therapy based upon the facts gained by experimentation and experience. It is the science of medicine that renders treatment reasonable and rational and without which the art of medicine may be a most wasteful and even dangerous empiricism.

Medical progress is most assured when the science and art of medicine are advancing hand in hand. Error is quickly discovered when theories which seem agreeable to reason are reduced to practice. Sir William Osler was accustomed to have his students place at the beginning of their notebooks on clinical medicine the following quotation from Froude, which he characterized as the alpha and omega of practical medicine:

"The knowledge which a man can use is the only real knowledge, the only knowl-

edge which has life and growth in it and converts itself into practical power. The rest hangs like dust about the brain or dries like raindrops off the stones."

The definition of medicine as an art and a science is applicable to every division and specialty of medical practice, and to none more accurately than to radiology. It is thirty-five years since the discovery of X-rays and during all of that time there has been a steady development of the art of radiology. The invention of more powerful, more dependable, and more accurate apparatus has necessitated constant change in technic, until the methods in use to-day bear little resemblance to those of twenty-five or even fifteen years ago. It has been comparatively lately that the science of radiology has made equal strides, but we have now at hand such a tremendous accumulation of data in the diagnostic field, and so much knowledge based on both experimentation and clinical experience in the field of therapy, that we may now expect steady and more nearly equal progress both as an art and a science.

I have written down the above statements, the truth of which is quite obvious, because it seems to me that upon the recognition of these facts must largely depend the attitude both of our ourselves and our medical colleagues towards this branch of medical practice. So long as radiology was

¹Presented before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, December 1-5, 1930.

considered only an art consisting of certain technical procedures there was no surety that it could hold a place as a special branch of medicine. It is unfortunate that many radiologists were so shortsighted as to accept even tacitly the position of technical assistants to the medical profession. It was inevitable that any radiologist who failed to establish himself on a sound scientific basis as a consultant in medicine and surgery would eventually be superseded by non-medical technicians directed by his medical confrères. The experience of radiologists who have conscientiously prepared themselves to act as medical consultants and who have persistently refused to become only technicians or photographers, or even so-called readers of X-ray films, has now demonstrated that radiology must be classed as a special branch of medical practice. Those who have had the most experience feel assured that radiological practice will remain largely in the hands of radiologists who are especially prepared to act in the capacity of medical consultants, notwithstanding the inevitable competition with those who do not maintain such a status in that branch of practice. Other branches of practice survive similar competition and there is no reason for supposing that radiology will not do so.

It would be well, however, for every radiologist to remind himself that the radiologist cannot really become a specialist in the sense that that term is generally used in medical practice. In general, the specialties in medicine denote limitation to some particular region of the body, *e.g.*, ophthalmology, urology, gynecology, etc. The only seeming exception to this is the general surgeon, who, after all, is a specialist only in the technical aspects of his calling. It is inconsistent to characterize the radiologist as a specialist when in the course of one day's practice he may consult with internists, surgeons, and representatives of practically every specialty. A day's practice may in-

volve examinations leading to the diagnosis and treatment of lesions in any part of the body. The radiologist is really a specialist, therefore, only in the same way that the general surgeon is one, that is, in the technical aspects of his calling.

How, then, shall a young man prepare himself for a career in radiology in which he will be required to consult with the general practitioner, the internist, the surgeon, the orthopedist, the urologist, the gynecologist, the ophthalmologist, and practitioners of practically every other branch of medicine and surgery; in which he will be required to become master of a very exacting technic, and in which he will find himself called upon to treat malignant disease in nearly any of its forms and to treat also a great variety of other conditions?

Let me set down briefly what seem to me the very minimum requirements for preparation to practise radiology. The only preparation possible in the undergraduate course is such as will indicate the fields in which radiology is useful, that is, information may be gained which will indicate the possibilities and the limitations of the X-ray in diagnosis and the X-ray and radium in treatment. After graduation the prospective radiologist secures appointment as interne in a good general hospital and serves for one year, rotating in the regular way on the various services. The second year he secures a residency in the same or another hospital and spends his time in more intensive study of a limited number of cases, with special attention to autopsies and gross pathology. During this year he begins special study of physiological chemistry or biochemistry and reviews his work in the physics of electrical energy and light. It cannot be too greatly emphasized that a thorough training in pathology is the essential foundation for the study of radiology, just as it is for internal medicine. During these two years of internship he will, of course, interest himself in the radiological

department, spending as much time as possible in its conferences and consulting freely with the radiological members of the hospital staff. It is not expected, however, that he will spend much time on the technical phases of radiology; his main work is to ground himself thoroughly in a knowledge of pathology and clinical medicine.

When this two years' preparatory work is finished he then enters upon a fellowship in radiology in a large radiological department. This should ordinarily extend over a period of at least two years. Here he first becomes acquainted, by actual practice, with the technical work of his chosen calling and continues throughout the period to perfect himself in the technic of diagnosis and therapy. It is true that he will later delegate many technical procedures to non-medical technicians, but the advantage of being thoroughly acquainted with these procedures himself is well known to all experienced radiologists. He becomes thoroughly acquainted with all the work of a radiological department by actually working in it; follows selected cases carefully from admittance to final discharge; attends operations and autopsies, and prepares at least one thesis on some radiological subject based upon an exhaustive study of cases. All of this work should be done under the direction and tutelage of a radiologist who is established and recognized as a consultant in order that proper ideals, as well as knowledge of radiology, may be inculcated.

At the end of this two years' fellowship he is now ready to become an assistant in radiology either in a hospital or in private practice and to really begin his training as a practical radiologist. If one keeps in mind that he is in training to become not a technician nor a reader of films but a consultant in internal medicine and in surgery, it will be recognized that the above statement is correct, namely, that he is ready to begin his training as a practical radiologist. His former training periods of internship and

fellowship have simply given him the foundation upon which to build, and he is still to attain the broad experience which will enable him to fill the important position of a consultant.

It is now essential that the young man who becomes an assistant in radiology be not so crowded with routine work that he has no time to pursue his education. His seniors should arrange his work so that he may attend meetings of societies, both general and radiological; that he may witness operations and autopsies; that he may prepare or assist in preparing papers based upon his work, and make occasional trips to other localities for the broadening effect to be obtained from contact with men working under different environments.

It is impossible to state just when his training will enable him to take his place as a consultant. Such a position comes gradually and depends much upon the man. That it can be obtained in less than five years is hardly possible even with the most brilliant men. If the majority of men receive wide recognition in their respective communities as consultants at the end of ten years' practice, they may consider themselves well repaid for the hard work of preparation.

Now what may a man who has prepared himself in the thorough manner indicated above reasonably expect from the profession and the public? First, he may and should expect to be received both in private and in hospital practice as the peer of his medical confrères. If he possesses those qualities of character and personality necessary in every good physician and takes advantage of his opportunities to identify himself with his patients and with his professional brethren as a practitioner of medicine in its broadest aspects, it is a practical certainty that they will receive him as a consultant on an equal basis with practitioners of surgery, internal medicine, or any of the specialties. The fact that he has not yet

everywhere received this recognition is due partly to the radiologist's own lack of vision. It is quite certain that our medical brethren and the management of hospitals will not place any higher valuation on the radiologist than the radiologist places on himself. If he is willing to make roentgenograms which are to be interpreted by others, or to be only a reader of films, and fails to establish a personal contact with every patient, there is no possibility of his being accorded a place as a medical consultant. If he is working in a hospital on a salary while the members of the medical and surgical staff are receiving their fees directly from their patients, he need not expect the latter to look upon him as an equal. He is in a very certain way the hired man of the hospital, to be used by the staff as they may direct. This is true even if the salary is as large or larger than the income he could expect if he depended upon fees from his patients; it is much worse, if, as is usually the case, a large percentage of the fees which should be his are appropriated by the hospital. It cannot be too strongly emphasized that the future of radiology depends upon the recognition of the radiologist as a consultant in medicine and surgery, and the radiologist owes it to himself to qualify for that position and to accept nothing less. It is a very shortsighted policy on the part of hospitals or of hospital standardization agencies to require the radiologic department to operate on a basis different from that of the other departments. It results in an inferior department in which there is neither enthusiasm nor individual initiative. It ought to be plain to all that hiring the radiologist for a hospital is only an opening wedge for the complete control of medicine by hospital managements and the hiring of surgeons and internists along with their janitors, firemen, etc. It is only the fact that many of our best hospitals have placed radiology on a par with other departments, and that the best men in the profession have

recognized radiologists as medical consultants, which gives us confidence to recommend radiology as a career to any young man entering the medical profession to-day. We have no hesitancy in so recommending it to any who are able and willing to properly prepare themselves for such a career.

There are ahead great possibilities for growth and expansion, and there is no doubt but that the field is large enough to engage all the powers of even the most brilliant students. Radiology has one advantage over most other medical specialties in that its scope is the whole field of medicine and surgery. The radiologist is not called upon to combat the narrowing influence which constantly menaces the specialist. Indeed, it taxes all of his powers to keep abreast of the advances in radiology and at the same time keep so familiar with the advances in surgery, internal medicine, and all the various specialties that he can view the problems of each intelligently, and in consultation talk to the representative of each in his own language. There is, in fact, no medical practitioner who needs to have such a broad knowledge of the entire field of medicine as does the radiologist.

Radiology has now reached a point in its development where it is on a sound foundation both as an art and a science. As an art, it has reached a degree of accuracy in technical procedure hardly equalled in other fields of medical practice; as a science, it reaches out into every field of medical knowledge. The pioneering work has been done and the dangers encountered by the pioneers are now past. For those who will properly equip themselves it offers not only an agreeable and interesting career but challenges the best powers they can bring to its practice.

DISCUSSION

DR. I. S. TROSTLER (Chicago): I feel that we should not permit this very important paper to go without commendation. It

tells us so much that we know to be true, and that I wish could be told to a larger audience. I wish the material in this paper could go out to the general medical profession. We know about all of these abuses; we know about all these criticisms that have been heaped upon us, and I wonder if there is not some way whereby this paper could be given wide publication, as it deserves.

DR. H. E. SCHAEF (London, Ontario, Canada): I was very much interested in listening to this paper, which represents our ideal. We know our own weakness; we know what we have gone through, and we know what is really required. For that reason we know what the other fellow should do, even though we ourselves have to plead guilty to wrong-doing. It reminds me of the time when I first became interested in radiology. You know, if we will think back on our own mistakes, we will not be quite so arbitrary, but, rather, we will be a little more lenient with some of the men who are going through their beginner days. My introduction into radiology was an accident. I was asked to take charge of the department in a hospital because the man who was in the position "flunked." It was really the best thing that could have happened, because the man should never have been there. None of you know him, so it does not matter. I replied frankly, "I know absolutely nothing about X-ray work." "Well, it doesn't matter, the technician is there and she will show you," was the answer. They were very much surprised that I would not take the position on any such conditions: I insisted on being given time to go away and learn something. Yet we do know that there are many men who are really doing work under practically the same conditions and eventually some of them make good. I do not know whether I am any good or not. We do know our weaknesses and it is a very difficult thing to say exactly what must be

done: it is a much easier thing to say what should be done. So far as I am concerned, it is a mighty good thing to have an ideal, but to insist on that ideal is a different matter. I think that we have hurt ourselves most of all by not being positive in our statements and by always leaving a loophole for ourselves. For that reason we are not considered consultants. I have always taken the stand that I would rather say what I think and be proven wrong than to give no positive statement and be in a position afterwards to say "I told you so." I believe that, even though we may eventually be proven wrong, it is better to give our frank opinion, say what we think, and let the autopsy prove the case. What I mean is this: if a surgeon says (the surgeons are the most arbitrary, after all is said and done), "I don't believe it—you are wrong," because our finding does not agree with his, we should be just as positive in making our statements as he is in making his. If the autopsy proves that we were wrong, or if we say, "Don't operate," and he insists on operating in spite of us and finds us incorrect, we should accept our error and profit by it and check back to see where we made our mistake. I believe that most of us are too weak-kneed in standing by our convictions, and if we did stand by them our prestige would rise among the general medical men.

DR. J. L. MCKNIGHT (Tucson, Arizona): Dr. Schaif caused me to smile. Like him, I was "kicked" into X-ray work by orders. I was called before the commanding officer of the Government Hospital in which I was serving as a tuberculosis specialist and told to take over the X-ray department. In the matter of preparation I had the advantage, whatever that was, of about twenty years in the practice of medicine and the further advantage that I had paid more attention to the X-ray than most

physicians were doing at that time. With the background of twenty years' practice of medicine and a rather thorough knowledge of tuberculosis, I was able to get along and have followed that line of work ever since.

I fully recognize that there are many, many things which I could have done better had I been able to follow such a program as that outlined by Dr. Groover; however, we cannot all receive that training—that is for the young men favored with such opportunities. We can succeed, as has been said here, only if we know something about the fundamentals of medicine. I was particularly impressed by Dr. Groover's remark that we must be able to speak the language of the various men in the profession, the internist, the surgeon, the specialist, and the dentist, in order to advise with each concerning cases in his own particular line. I wish to say that one's success in radiology is dependent, in my opinion, more on his knowledge of medicine and surgery than on his technical training in the X-ray.

DR. LEON J. MENVILLE (New Orleans, La.): I was not fortunate enough to be here to listen to this paper, though I wished to do so. Judging from the discussion I have heard, the radiologist, as a whole, is rather timid, and he is timid because of the fact that he has been looked upon as a technician. Also because he appreciates that only a small percentage of the medical profession understands the limitations of and indications for radiology. Ours is a work of

education. The profession must be made to realize that a roentgenologist is a physician who derives a diagnosis not alone from shadows, but reads into these shadows, anatomy, physiology, pathology, and medicine, and for this reason he must be considered as a medical consultant in a manner similar to other physicians practising highly specialized branches of medicine.

DR. GROOVER (closing): I wish to thank the members for their liberal discussion. I also especially want to thank Dr. Richards and Dr. Trostler for their complimentary references to the editorial published in the *American Journal of Roentgenology and Radium Therapy* last August. The paper I presented this afternoon is really an outgrowth of that editorial. I hope that in perusing the paper, no one will get the idea that I am criticising the radiologists. No one realizes better than I that there are many able men throughout the country who are practising radiology under more or less duress and under wellnigh intolerable conditions over which they have no control. Nor did I have any idea of trying to eradicate at one fell swoop the many evils which we recognize as existing to-day in the practice of radiology. Notwithstanding these, I believe that radiology is on a sound foundation. I was merely trying to indicate what I thought the radiologist of the future would be, and perhaps guide some of the younger radiologists and prospective radiologists along sane and scientific lines.

THE ROENTGENOLOGIC SIGNIFICANCE OF PYLORIC AND PREPYLORIC DEFORMITIES¹

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THE interpretation of deformities of the pyloric end of the stomach below the incisura angularis as observed in roentgenograms and on the fluoroscopic screen has long been a perplexing problem to the roentgenologist, and it is a peculiar but significant fact that this segment of the stomach which is most accessible to roentgenologic observation offers more diagnostic difficulties than any other. The reasons for this are many when one considers that 60 per cent of all gastric carcinomas (6), 69 per cent of benign gastric tumors (4), and approximately 10 per cent of gastric ulcers (7) are found within this area. This region is also a favorite site for spasm, which has been properly termed "the arch deceiver" of the roentgenologist.

It is needless to state that fluoroscopic observation is indispensable to a thorough examination of the pyloric area and this is best accomplished by using only a small amount of barium. The patient is instructed to take two swallows of the opaque mixture and as this enters the stomach it is manipulated by the hand of the examiner in such fashion as to delineate the mucosal markings in all areas. At this time the mucosal changes associated with early carcinoma are best detected, and as a means of establishing an earlier diagnosis of this disease I would urge a more general use of such a procedure. The examination may be completed by giving the remaining portion of the barium meal in order to study the duodenum and determine the gastric tonus, peristaltic activity, and motility.

A list of pathologic conditions affecting the pars pylorica would include most of the

lesions to which the stomach is subject. In the differential diagnosis of roentgenologic defects, however, one is concerned chiefly with the differentiation of malignancy, benign ulcer, pylorospasm, syphilis, and hypertrophic pyloric stenosis. The co-existence of spasm, especially with inflammatory lesions, does much to impair their differentiation. In the consideration of ulcerating lesions occurring in the pyloric region the examiner must take cognizance of the fact that here carcinoma greatly outnumbers benign ulcer. Prepyloric ulcer also has a greater predilection for undergoing malignant degeneration (33 per cent) (13) than ulcers elsewhere in the stomach. Thus at the outset, the odds are high in favor of a malignant lesion when ulceration can be demonstrated. Because of its accessibility to examination, pyloric carcinoma should be diagnosed earlier than that in the pars media or cardia. This undoubtedly occurs, but as yet the disease is not being diagnosed early enough, as indicated by the fact that of 2,078 cases of carcinoma of the stomach, seen at The Mayo Clinic between the years 1920 and 1924, the condition was found to be hopelessly inoperable in approximately 50 per cent. In 25 per cent exploration was done and an inoperable lesion was found. In the remaining 25 per cent resection was accomplished.

PYLORIC CARCINOMA

For practical roentgenologic consideration pyloric carcinoma may be grouped as follows: (1) polypoid carcinoma, with or without ulceration; (2) scirrhus carcinoma; (3) malignant degeneration of benign ulcer, and (4) malignant degeneration of benign tumor.

¹Read before the Radiological Society of North America, Los Angeles, California, Dec. 1 to 5, 1930.



Fig. 1. Ulcerating carcinoma on lesser curvature at pyloric end of stomach showing "meniscus sign."



Fig. 2. Ulcerating carcinoma on posterior wall at pyloric end of stomach showing crater and "halo" sign. Duodenal ulcer.

Polypoid Carcinoma.—This growth has a predilection for the lesser curvature and early may be discerned as an interruption in the continuity of the gastric mucosal markings at the site of the malignant invasion. As the lesion increases in size the defect becomes more apparent, its margins are more sharply delineated, and ulceration is usually present. The crater is generally broad, shallow, and irregular and when present on the lesser curvature has a characteristic "meniscus-like" appearance when pressure is made over it (Fig. 1). Frequently when the palpating hand is passed down over the defect, the mass will roll from under the fingers and the shadow of the crater will rise above the tips of the fingers if the hand is pushed upward. When seen *en face* on the posterior wall the carcinomatous crater is surrounded by a halo effect which represents the surrounding

ridge of malignant induration (Fig. 2). When the pressure of the examining hand is released the defect is generally obscured by the overlying mass of barium. Not infrequently a growth will encircle the pylorus and produce the picture of pyloric obstruction. Owing to the marked stenosis, the lesion itself may be obscured and unless barium can be ejected through the pylorus and the site of the obstruction definitely established the examiner should be content with the diagnosis of an obstructing lesion at the outlet, for chronic stenosing duodenal ulcer can mimic an encircling carcinoma at the pylorus and is much more common. Not uncommonly persistent pylorospasm from a gastric ulcer higher in the stomach will imitate pyloric obstruction (Fig. 3). In such cases the diagnosis rests on the finding of the ulcer niche higher in the stomach. The search for this and also the craters of small



Fig. 3. Pylorospasm and obstruction produced by gastric ulcer on lesser curvature at angle of stomach.



Fig. 4. Ulcer crater in pyloric ring. Duodenal cap also deformed.

carcinomas will be greatly facilitated if the stomach is thoroughly lavaged just before the roentgenologic examination.

When looking for early polypoid carcinoma one may be deceived by hypertrophied gastric rugæ and redundant folds of mucosa in the pyloric area. The latter may occasionally prolapse through the pyloric ring and produce a pseudodeformity of the pylorus and duodenum. Manipulation will show such areas to be flexible, free from induration, and exhibiting normal peristalsis. The prolapse may even be reduced during the examination. Localized gastric polyposis may also confuse the examiner, but here the flexibility of the region and the presence of peristalsis will serve to indicate the benign nature of the lesion.

There have been described certain forms of gastritis as related to gastric carcinoma and ulcer, and the roentgenologic appearance

of these changes has been considered by Berg, Haudek, Albrecht and others. According to Orator, the inflammatory changes accompanying ulcer and shown as mucosal hypertrophy are confined to the prepyloric segment, whereas in carcinoma they are generalized and show as high-grade atrophy of the mucous membrane. Haudek suggested that it should be possible eventually to establish an anatomic differentiation of precarcinomatous gastritis and gastritis with a predisposition to ulcer. This would indeed be an ideal state of affairs, but at the present time there is so much doubt regarding the significance and proper interpretation of many of these mucosal changes that one must not be influenced too greatly by their presence in doubtful cases. Carefully correlated roentgenologic and pathologic studies are necessary before serious appraisal of their value may be given.



Fig. 5. Scirrhus carcinoma at pyloric end of stomach. Defect simulates prepyloric ulcer without demonstrable crater.

Scirrhus Carcinoma.—In the pyloric area this growth is commonly imitated by syphilis, prepyloric ulcer, pylorospasm, hypertrophic pyloric stenosis, and malignant lymphoma. The differential diagnosis rests on the persistence of the deformity, the slightly serrated outline of the area involved, loss of flexibility, absence of peristalsis, obliteration of the mucosal markings, and the presence of a mass coinciding with the defect. Malignant lymphoma can rarely be distinguished from carcinoma and is usually so diagnosed even at operation. Despite the similarity of the defects in syphilis and tuberculosis one rarely can palpate a corresponding mass in these conditions. Hypertrophic pyloric stenosis and prepyloric ulcer are frequently accompanied by signs of partial pyloric obstruction and gastric dilatation, whereas in scirrhus carcinoma the stomach is diminished in size and the rigid pylorus causes rapid emptying and secondary dilata-



Fig. 6. Irregular pylorospasm produced by small gastric ulcer high in stomach. Ulcer niche is not visible.

tion of the duodenal bulb. The presence of a small rounded crater favors the diagnosis of ulcer. In some cases the positive exclusion of the presence of malignancy is impossible, as in early scirrhus carcinoma the mucosal markings may not be recognizably altered and feeble peristalsis can be noted in the involved area. Under these circumstances the distinction from inflammatory lesions, benign muscular hypertrophy, and persistent pylorospasm of intrinsic origin is usually impossible. Such cases, in this and other groups, justify the statement! "In the discovery of operable carcinoma it is necessary to advise exploration in a certain number of cases in which it is impossible to be sure before operation whether or not the lesion is malignant" (11). Under these circumstances the roentgenologist may find some consolation in the fact that occasionally the surgeon and even the pathologist cannot render a conclusive diagnosis when the specimen is in hand.

Malignant Degeneration of Benign Ulcer.—Statistics indicate that prepyloric ulcers



Fig. 7. Deformity of prepyloric area and duodenum caused by pedunculated adenoma prolapsed through pylorus.



Fig. 8. Syphilitic deformity at pyloric end of stomach. Dilatation of duodenum and feeble peristalsis may be noted.

are more prone to undergo malignant degeneration than ulcers elsewhere in the stomach. Orator states that a third of the prepyloric ulcers, and only 3 per cent of ulcers in the pars media, undergo malignant degeneration: Alvarez and MacCarty have stated that 23 per cent of carcinomas resected at The Mayo Clinic are within the range of size of benign ulcer. According to their statistics an ulcer less than 2.5 cm. in diameter has one chance in ten of being malignant; if it is larger than this, the chances are two to one that it is carcinoma, and if the crater is larger than 3.5 cm. it is certainly carcinoma. Presser described five cases in which roentgenologic examination disclosed a larger ulcer niche and at necropsy the lesion proved to be malignant. Roentgenologically there is nothing to indicate malignancy in an ulcer other than the size of the crater and, in rare instances, the presence of the changes of

malignant induration about it. Roentgenoscopically the latter is revealed as an obliteration of the mucosal markings about the edge of the ulcer and in more advanced cases by the presence of the "halo effect" as seen in ulcerating carcinoma.

Malignant Degeneration of Benign Tumor.—Statistics show that the prepyloric area is the most common site of benign gastric tumor. Experience has shown that these tumors, especially adenomas that have attained an appreciable size (2 to 3 cm.), are quite likely to reveal evidence of carcinoma when examined by the pathologist. Wechselmann has stated that carcinomatous degeneration occurs possibly in 60 per cent of all adenomas, and Anschütz and Konjetzny have said that the majority of gastric carcinomas originate from adenomas and polypi or, at all events, from an adenomatous precarcinomatous stage. Grossly

these tumors appear benign and are so recognized by the roentgenologist, who has ascribed to them certain characteristic signs. It is obvious that fluoroscopic manipulation is usually necessary to distinguish these tumors from polypoid carcinomas. The flexibility of the gastric wall, the presence of peristalsis over the defect, and the abrupt termination of the gastric rugæ at the site of the tumor all denote the grossly benign character of the lesion. The majority of benign gastric neoplasms are soft and easily compressible, and in most instances a clearly defined mass corresponding to the defect is not felt. It has been my experience that when a definite mass is palpable the lesion will usually prove to be carcinoma.

The various gastric bezoars may sometimes confuse the diagnosis of neoplasm. The benign characteristics of the filling defect and the clinical history should facilitate the differentiation. Ulceration in association with bezoars is not uncommon.

PREPYLORIC CONDITIONS

Prepyloric ulcer exhibits the same general roentgenologic characteristics as gastric ulcer elsewhere. The spasm associated is marked and out of proportion to the size of the crater. Because of this and the proximity of the lesion to the outlet of the stomach the patient usually seeks relief before the crater has reached the size of ulcers seen elsewhere. The shadow of the crater, therefore, is likely to be small and difficult to demonstrate. It is usually present on the lesser curvature and surrounded by more or less induration and spasm. By virtue of its position the niche does not retain barium as readily as ulcers higher on the lesser curvature, and careful palpation may be necessary to detect it. One must not be confused by flecks of barium held up temporarily by folds of the mucosa, by a pseudo-niche produced between two peristaltic

waves, or by barium in the duodenum behind the stomach. Infrequently one may distinguish a fleck of barium directly within the pylorus, and again the crater may appear so close to the pylorus that it is difficult to determine on which side of the pyloric ring it is situated (Fig. 4). The majority of the so-called pyloric ulcers when checked by the surgeon and pathologist prove to be duodenal ulcers at the base of the cap, adjacent to and occasionally involving the pyloric ring. Usually the exact situation is rendered uncertain by the associated pylorospasm which narrows the outlet and elongates the usual pyloric constriction. In many cases of pylorospasm without ulcer and of hypertrophic pyloric stenosis it is not uncommon to find a small fleck of barium retained in the pyloric ring when pressure is exerted over it. Repeated manipulations will usually dislodge the fleck from time to time and this inconstant appearance distinguishes it from a true niche. Coincident spastic phenomena will aid in detection of a true crater.

The most constant deformity concomitant with prepyloric ulcer is flattening of the lesser curvature proximal to the pylorus, produced by spastic contraction of the longitudinal muscle in the affected area and the associated inflammatory edema in the mucosa and submucosa. This results in an eccentric position of the pyloric opening as related to the duodenal cap. The greater curvature contiguous to the pylorus is drawn toward the lesser curvature by the coincident spasm of the circular muscle. The outlet is further narrowed by the associated edema so that the pyloric canal appears to be elongated. Without the presence of a niche deformity these changes should be interpreted with considerable caution, for they are imitated commonly by scirrhus carcinoma (Fig. 5), syphilis, pylorospasm from gastric ulcer elsewhere, and hypertrophic pyloric stenosis. Spastic incisuras when accompany-

ing prepyloric ulcer are usually single and occur on the greater curvature at a distance of 0.5 to 2 cm. from the pylorus. They may be imitated by peristaltic phenomena, redundant mucosal folds, perigastric adhesions, and spasm of extrinsic origin. Incisuras on the lesser curvature are rare.

Spastic phenomena at the pylorus (Fig. 6) are so consistently produced by ulcers elsewhere in the stomach that such a lesion should be carefully sought in all cases even though a prepyloric niche may be demonstrable. Occasionally a perforating duodenal ulcer will produce so much deformity in the base of the duodenum, pylorus, and prepyloric segment that one is in doubt as to the primary site of the lesion. In such cases, with associated deformity of the duodenal bulb, a diagnosis of duodenal ulcer is justifiable, as gastric lesions involving the duodenum secondarily are quite rare. A small pedunculated gastric tumor prolapsing through the pylorus (Fig. 7) can easily simulate this appearance, but fluoroscopic manipulation should facilitate the diagnosis. It should be borne in mind, however, that duodenal ulcer may co-exist with a prepyloric malignant lesion.

Formation of a diverticulum secondary to a stenosing prepyloric ulcer is rare; when present it is generally found on the greater curvature and must be distinguished from primary diverticula and spastic phenomena.

In a summary of the facts concerning prepyloric ulcer it becomes apparent that the roentgenologic simulants of this lesion are numerous and far more common than prepyloric ulcer itself. In the face of these facts and in the light of my own experience, I would urge withholding such a diagnosis unless an ulcer niche can be demonstrated without question. Herrnheiser's experience is an example of the uncertainty of these changes when the niche shadow is absent or questionable. In his series of thirty-two cases in which a diagnosis of pyloric or prepyloric

ulcer was made by the roentgenologist and in which necropsy was performed, the data were negative in sixteen cases, in two they were explained by prepyloric adhesions without a gastric lesion, and in fourteen the diagnosis of lesion was confirmed.

Gastric syphilis commonly involves the pyloric area and this region was affected in 70 per cent of Moore's series. The predominating change is a diffuse gummatous infiltration of the gastric wall, which produces roentgenologic changes simulating scirrhus carcinoma, prepyloric ulcer, and hypertrophic pyloric stenosis. The prepyloric segment is narrowed in a concentric and symmetric manner and the mucosal markings are obliterated (Fig. 8). Rapid emptying of the stomach, with secondary dilatation of the duodenal cap, is the rule and pyloric obstruction is rare. The striking difference from scirrhus carcinoma is the absence of a palpable mass. The history of the case and the absence of cachexia will also suggest the diagnosis of syphilis. Following antisyphilitic treatment, the gastric defect may be diminished as the inflammatory reaction and associated spasm recede. On the other hand, the resulting cicatricial changes may increase the original defect and thus suggest advancing malignancy. Here again the distinction will rest on the absence of a palpable mass, the symptomatic improvement of the patient, and the absence of cachexia. Hypertrophic pyloric stenosis and prepyloric ulcer may be distinguished from syphilis by the presence of normal mucosal markings, the evidence of partial gastric obstruction, and the niche deformity accompanying ulcer.

Pyloric narrowing produced by hypertrophy of the pyloric musculature will simulate early prepyloric disease. The symmetric annular narrowing, with elongation of the pyloric canal, typifies this abnormality, which is not affected by antispasmodics. The pylorus is never gaping and partial obstruction



Fig. 9. Hypertrophic pyloric muscle and pylorospasm produced by small gastric ulcer at angle of stomach.



Fig. 10. Pressure deformity at pyloric end of stomach produced by large malignant liver.

is the rule. The gastric mucosa is unchanged. Hypertrophy of the pyloric muscle is so commonly associated with gastric ulcer (Fig. 9) and obstructing duodenal ulcer that these lesions must be excluded before the primary nature of the hypertrophy can be established. Syphilis and scirrhus carcinoma may be distinguished by the absence of a gaping pylorus or a tumor and the presence of normal mucosa and gastric retention.

EXTRA-GASTRIC CONDITIONS

Extra-gastric conditions that secondarily deform the pyloric area are: (1) reflex spasm, (2) extrinsic pressure, (3) adhesions, and (4) malignant disease, with secondary infiltration of the stomach.

Reflex spasm should be suspected when there is no direct evidence of gastric dis-

ease and the mucosa appears normal. The deformity may be effaced by manual manipulation, it will change in character and position at subsequent examinations, and can be removed by antispasmodics. Spasm due to gastric crisis and lead colic is little affected by the usual antispasmodics, but the changes are of a general nature and do not affect the pyloric area alone.

Fluoroscopic manipulation will serve to distinguish defects due to extrinsic pressure. In such cases the gastric walls maintain their flexibility and peristaltic activity. It is significant that the mucosal markings are maintained in the affected region (Fig. 10). Pseudodeflects due to pressure on the spine and gas in the colon should be obvious to the careful examiner. In apprehensive and muscular patients the pylorus may be distorted by pressure from tense abdominal muscles. The defect will disappear when

the patient is relaxed and at ease. Defects due to food and secretion should be obvious to the alert observer, and re-examination after fasting or lavage will suffice to check the doubtful case.

Occasionally a malignant tumor of the pancreas will involve the posterior wall of the pyloric area secondarily and undergo ulceration. Here the presence of the irregular crater is easily mistaken for a primary gastric malignant lesion and in many instances the distinction between the two roentgenologically is impossible. Secondary invasion of the stomach by malignant disease of the colon may also confound the examiner, unless the mucosal markings are intact.

COMMENT

Besides the deformities under consideration it is recognized that there are other rare and unusual conditions which may involve the pyloric area. Their incidence, however, is such that they are seldom of practical concern to the average roentgenologist, and, therefore, have not been considered here.

Because of the multiplicity of conditions affecting the pylorus and pyloric area, it is not surprising that on many occasions the examiner is taxed to the utmost in arriving at a conclusive diagnosis. In some cases one must be content with a descriptive or indeterminate diagnosis, for, in the last analysis, as roentgenologists, we are largely dependent on what we see, and when more

than one disease may produce grossly the same pathologic picture, the decision must be left to the clinician, surgeon, and pathologist.

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THEORY OF X-RAY QUALITY MEASUREMENT

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PART I

THE measurement of the quantity of X-radiation has been placed upon a rational physical basis. The r-unit and its application has progressed to the point where it is quite definite and theoretically justifiable. The measurement of quality, on the other hand, is still in a state of indefiniteness. A great deal of experimental work has been done, but certain general theoretical considerations seem to have been insufficiently stressed.

There are at present a number of methods of designating the quality of X-radiation. Any method depending on the spectrograph must be excluded because of the practical difficulties. The methods of practical importance are the following:

I. Effective wave length by absorption in a fixed layer of Cu or Al.

II. Effective wave length by absorption in a layer of Cu or Al of such thickness that the incident energy is reduced to half by passage through the filter (half value layer).

III. Effective wave length from the absorption coefficient corresponding to the slope of the absorption curve in Cu, Al, or tissue for varying thickness of absorbing material.

A general definition of effective wave length is the following:

The effective wave length of a complex radiation is the wave length of the homogeneous radiation which, with the same intensity, produces the same effect as the complex.

The various methods of measuring effective wave length differ in the effect to be considered. In Method I the effect is the

absorption in a fixed thickness of a specified material. In Method II the effect is the absorption in the half value layer of a specified material. In Method III the effect is practically the absorption in a very thin layer of a specified material.

It is possible to define the average wave length without all the indefiniteness of these methods. Some of the possible definitions of this more general type are as follows:

(A) The average wave length of a complex radiation is the arithmetic average of the wave lengths present in the complex, weighted according to the intensity per unit wave length interval.

(B) The average wave length of a complex radiation is the wave length corresponding to the arithmetic average of the frequencies present in the complex, weighted according to the intensity per unit frequency interval.

(C) The average wave length of a complex radiation is the wave length corresponding to the average of the absorption coefficients in Cu, Al, or tissue of all the components of the complex, weighted according to the intensity per unit difference in absorption coefficient.

(D) The average wave length of a complex radiation is the wave length corresponding to the arithmetic average of the frequencies present in the complex, weighted according to the number of quanta per unit frequency interval.

These four definitions base the effective wave length upon qualities inherent in the composition of the complex radiation, rather than upon a specified experiment. Logically, of course, it is not necessary to prefer this

type of definition, but the physical significance of the latter four is certainly greater.

DETAILED DISCUSSION OF "PHYSICAL" DEFINITIONS

(A) The definition of the average wave length as an arithmetic average wave length is, logically, perhaps the simplest of all. This average may be realized experimentally for any radiation complex by comparing the reading on an air ionization chamber with that taken for the same radiation with an ionization chamber so constructed that the response increases with wave length in direct ratio.

(B) The average wave length defined in this way seems to have slight physical significance. This average wave length is not the quantity which determines the magnitude of the individual quanta. It may theoretically be measured by the use of a hypothetical ionization chamber the response of which is proportional to frequency.

(C) At first sight the definition of effective wave length as that corresponding to the average absorption coefficient in Cu, Al, or tissue would seem to be suffering from the same indefiniteness for which the practical definitions were criticized. It turns out, however, that for radiation considered in roentgenology, all of which is harder than Cu K radiation, the three alternatives lead to numerically equal results. The experimental realization of this quantity is simple indeed. It is the result obtained from Method III above. That the result of this method satisfies Definition C and is independent of the material selected for the measurement will be proven and is deserving of emphasis. The physical significance of this type of effective wave length is obvious. The importance of the absorption characteristics of the radiation is sufficient to warrant its use.

(D) It may be shown (Part II) that the wave length defined in this way is the same as that given by Method A. Because of its

great significance¹ it would seem to be worth while to attempt its measurement. A suggestion in this direction will be given in Part II.

NUMERICAL COMPARISON

The numerical value for the effective wave length of any actual radiation may be found by any of the methods herein discussed. There is, as yet, however, no practicable way of arriving at the value from Methods A, B, and D. We have suggested methods but have not as yet carried them into practice. For this reason it will be better to assume a definite spectral distribution and work out the numerical value of the effective wave length by calculation. In that way we shall arrive at values for all the possible methods.

For simplicity, let us assume the radiation to consist of 20 units of monochromatic radiation of wave length 0.1 Ångström and 10 units of monochromatic radiation of wave length 0.5 Ångström. Figure 1 is a graph of the absorption coefficients in Cu which will prove convenient for this discussion.

Method I.—Let us take the fixed thickness of material as 1 mm. Cu. The absorption coefficients for the two wave lengths here considered are 3.0 and 170, respectively. After passage through 1 mm. Cu the harder component is reduced in intensity from 20 to 15.8 units, while the softer component is practically completely absorbed. Thus the 30 units incident on the filter are reduced to 15.8, or to 52.5 per cent. Such a reduction would be suffered by monochromatic radiation of absorption coefficient 6.42. From Figure 1 this corresponds to a wave length of 0.15 Å. unit.

Method II.—Carrying out the computation in a similar way, we find that the half value layer is 0.96 millimeter. The absorp-

¹A. Mutscheller: Fortschr. a. d. Geb. d. Röntgenstr., June, 1930, XLI, 899. The idea of an effective wave length such as here indicated, is proposed. The author, however, calculates his average frequency or quantum energy from an effective wave length derived according to Method III.

tion coefficient corresponding to a 50 per cent reduction in this thickness is 7.22, giving an effective wave length of 0.16 Å. unit.

Method III.—It is unnecessary to go through the details of the computation which involves the calculation of absorption in a number of increasingly thick layers, the

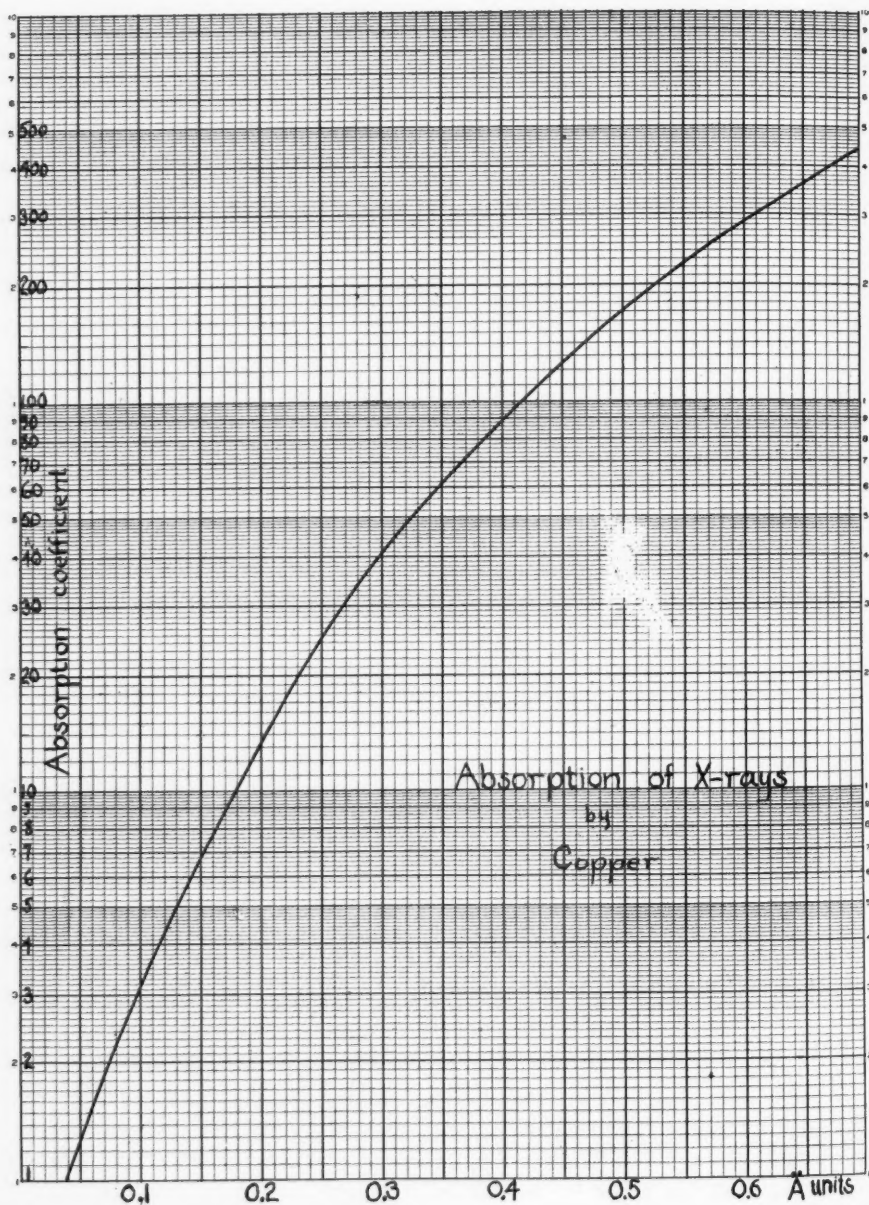


Fig. 1. A graph of the absorption coefficients in Cu which will prove convenient for this discussion.

drawing of the curve and evaluating its slope. The value for the effective wave length found by this method is 0.35 Å. unit.

Method A.—The arithmetic average wave length properly weighted is found as follows:

$$(20 \times .1 + 10 \times .5) \div 30 = 0.23 \text{ Å. unit.}$$

Method B.—The arithmetic average frequency may be found similarly. Noting that the frequencies of our two components are 3×10^{18} and 6×10^{18} , respectively, we have for the weighted average

$$(20 \times 3 \times 10^{18} + 10 \times 6 \times 10^{18}) \div 30 = 22 \times 10^{18},$$

which corresponds to a wave length of 0.14 Å. unit.

Method C.—The arithmetic average absorption coefficient in copper is found as follows:

$$(20 \times 3.0 + 10 \times 170) \div 30 = 58.7,$$

corresponding to a wave length of 0.35 Å. unit. In Part II it will be shown that the agreement with the result of Method I is not fortuitous, and that the result would have been the same if Al or tissue had been used.

Method D.—This arithmetic average frequency may be found by direct calculation. The result, as will be proved in Part II, must be the same as that of Method A, namely, 0.23 Å. unit.

These results may be summarized:

Method	Effective wave length, Å. units
I Absorption in 1 mm. Cu.....	0.15
II Half value layer—Cu.....	0.16
III Absorption curve slope.....	0.35
A Average wave length.....	0.23
B Average frequency (energy).....	0.14
C Average absorption.....	0.35
D Average frequency (quantum)	0.23

The variations among the values as found by the different methods for the hypothetical radiation for which we have been able simply to compute the values will be found

with any radiation. That the Methods I, II, and III yield different results in practice is an experimental fact. In order to demonstrate more clearly the cause of the differences among the results of the Methods A, B, and C we have drawn Figure 2. Curve I is an arbitrary wave length spectrum. Curve II shows the same radiation represented on a frequency scale. Curve III shows the same radiation represented on a scale of Cu absorption coefficients. The average wave length is the wave length of the center of gravity of the area under Curve I. The average frequency is that of the center of gravity of the area under Curve II. The average absorption coefficient is that of the center of gravity of the area under Curve III. It is evident that the curves show slight similarity. It is for this reason that the averages are different for the different methods.

The three Methods, I, II, and III, differ among themselves. Method I gives the advantage to shorter wave lengths, so that the effective wave length so measured is shorter the thicker the filter used. The half value layer method (II) differs from the others, always giving a shorter wave length than Method III, but shorter or longer than Method I, depending on the half value layer, so that for hard radiations the result of Method II is shorter than that of Method I, and for soft radiations longer than Method I. Method III gives a result always longer than the other two methods. To the result of Method III there must be attached fundamental theoretical importance because the result is independent of the material used and is equal to the wave length corresponding to the average absorption coefficient in any material not having an absorption discontinuity in the region considered.

The absorption curve which must be drawn in order to apply Method III, or C, also has fundamental theoretical significance in that no two complex radiations will give

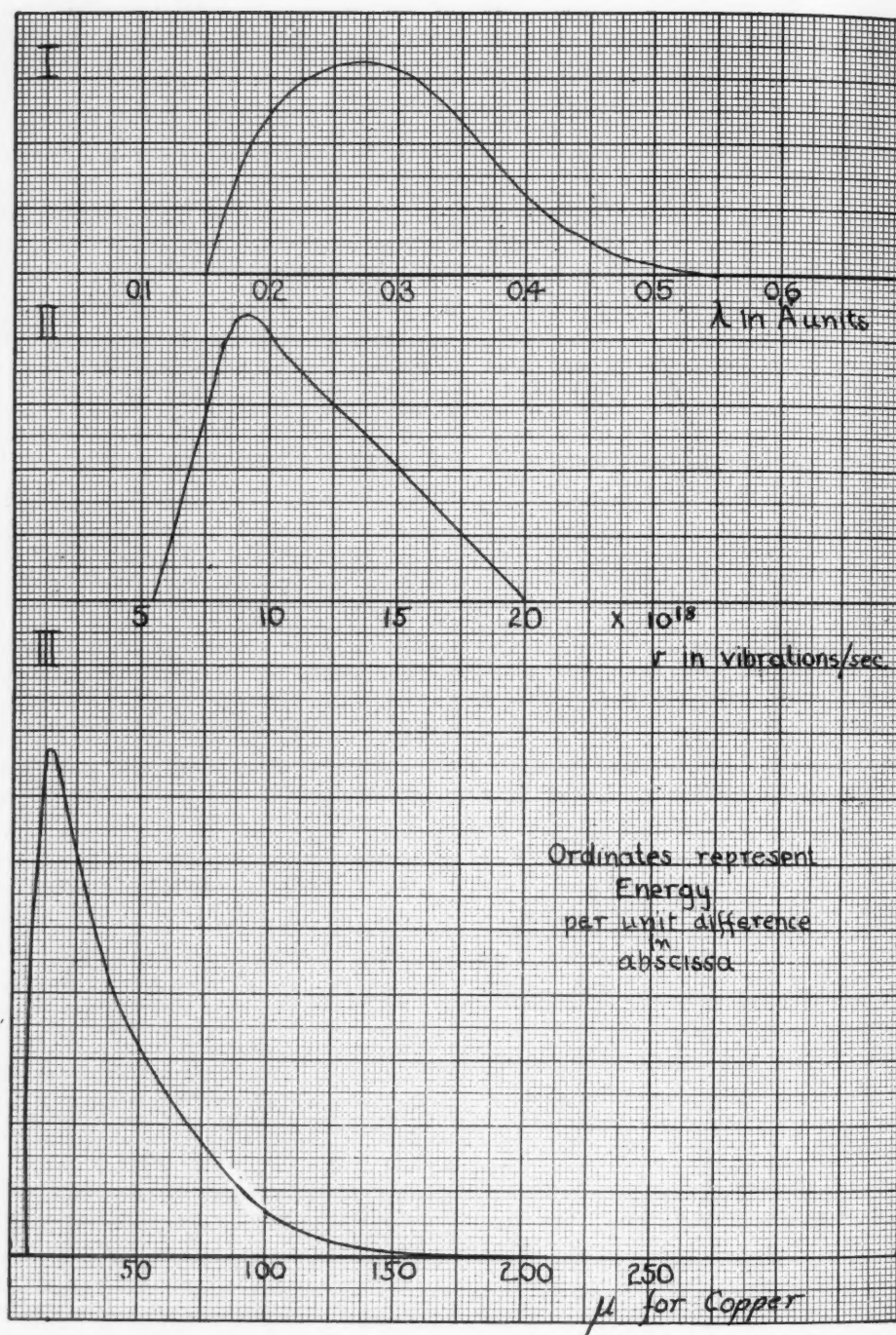


Fig. 2. A graph to demonstrate more clearly the cause of the differences among the results of the Methods A, B, and C.

identically the same curve, unless the energy distributions in the two complexes are identical. If two complex radiations do give identically the same curve, it follows that the spectra of these two radiations are identical. The absorption curve plotted in the usual way can never be a straight line. It will be shown in Part II that the absorption curve must continue to turn until its slope corresponds to the absorption coefficient for the minimum wave length of the radiation in question. There is no thickness of filter beyond which no additional hardening can be produced. It is physically obvious, however, that the greater the degree of homogeneity of the radiation, the straighter will be the absorption curve (logarithmic).

HOMOGENEITY

The value of the effective wave length having been determined, there still remains an important quality characteristic of a complex radiation which is undetermined. This characteristic has been called the "homogeneity." Two different complex radiations may have the same effective wave length, yet one may be composed of a series of wave lengths extending over a large spectral region, while the other may be a narrow band of wave length concentrated closely about the effective wave length. The latter type would be very homogeneous, while the former would be very inhomogeneous.

Various methods of measuring homogeneity have been proposed. Christen has proposed as a measure of homogeneity the ratio of the second to the first half value layer. Obviously if the radiation were perfectly homogeneous this ratio would be unity, otherwise it would be greater than unity, because of the hardening effect of the first half value layer. Jacobi and Liechti² have proposed the ratio of the effective wave length (Method II) to the minimum wave

length determined from a sphere gap measurement of voltage. Here again completely homogeneous radiation would yield the value unity, while any actual radiation would yield values greater than this.

Both of these methods, as well as variations which suggest themselves immediately, are unsatisfactory if judged by the standards adopted here. Any method depending upon successive absorptions in definite layers, or in half value layers, will depend for its result upon the material used for the measurement. Methods involving a sphere gap reading are open to the objection that they are not, strictly speaking, measurements of the radiation itself. The method of choice should be one depending on absorption measurements alone, but yielding a figure for the homogeneity which would be independent of the specific material used. Such a method is here proposed. The measure of homogeneity is defined as the product of the effective wave length into the cube root of the ratio of the root mean square variation in absorption coefficient from the average to the average coefficient of true absorption (less scatter). The value so obtained has the dimensions of wave length, is independent of the material used in the measurement, and can be found without any data beyond those necessary for the determination of the effective wave length (Method III). This measure of homogeneity differs from the coefficients mentioned above in that it has an actual physical significance, being an effective wave length spread of the radiation. As such, for perfect homogeneity, its value is not unity, but zero. The calculation from the data found for the determination of effective wave length is based upon the fact that the mean square variation of absorption coefficient is equal to the rate of decrease of average absorption coefficient with increasing filter thickness. This fact, and the independence of material will be proved in

²H. Jacobi and A. Liechti: *Strahlentherapie*, 1928, XXIX, 503.

Part II. The method of calculating both the effective wave length and the homogeneity can best be understood from an actual example.

The curve of Figure 3 is the absorption curve referred to above, for an actual case. The conditions were: 150 K.V. constant potential, 3 milliamperes. The ordinates of this curve are the percentages transmitted through various filters, taking the intensity through 0.3 mm. Cu as 100 per cent. The abscissæ are the filter thicknesses in millimeters. The dashed lines in the figure are tangents drawn to the curve at points corresponding to 0.3, 0.5, 0.7, 0.9 millimeter filter, respectively. A vertical line is drawn corresponding to a filter of thickness 1.3 mm., or 1 mm. more than the initial filter thickness. The intersections of the tangents,

the initial line, and the line just mentioned are marked as indicated. The average absorption coefficients for the various filters are found easily with the help of Figure 4. For example, the average absorption coefficient for filter 0.5 is found from line BB', which is the tangent to the curve at the point corresponding to 0.5 millimeter. The ordinates of the ends of this line (points B and B') are 90 per cent and 17 per cent, respectively. The ratio is 19 per cent. From Figure 4, we see that a transmission of 19 per cent through 1 mm. represents an absorption coefficient of 15. This is the average absorption coefficient for the radiation in question filtered through 0.5 Cu. The corresponding effective wave length may be found from Figure 1, which gives 0.21 Å. unit.

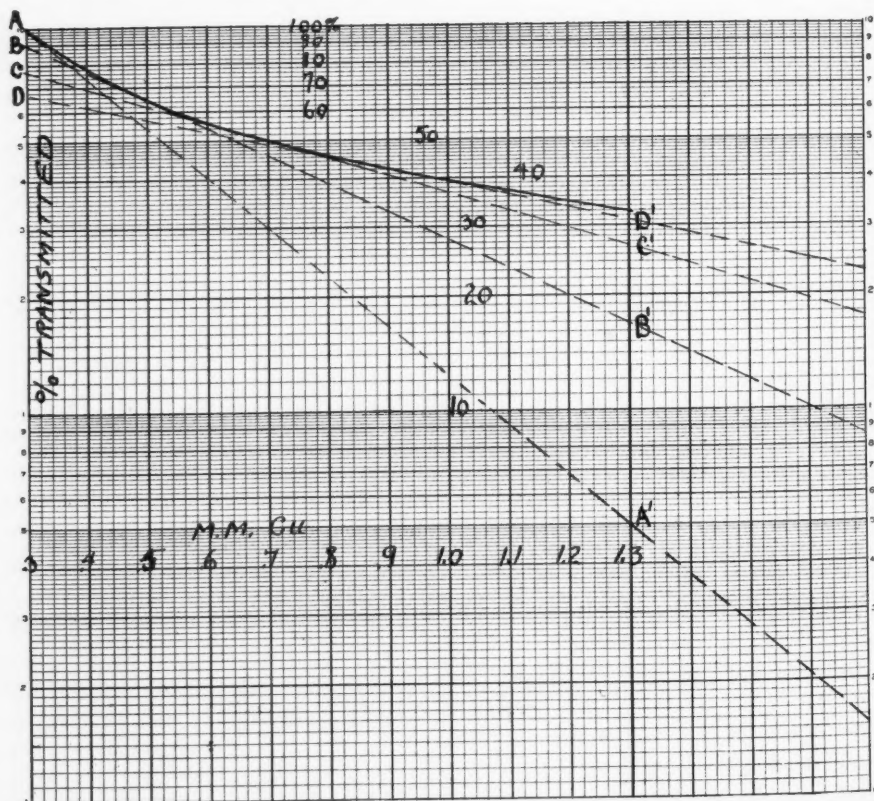


Fig. 3. Absorption curve for which conditions are: 150 K.V. constant potential, 3 milliamperes.

In order to find the measure of homogeneity the average absorption coefficients are found for all the tangents drawn, and a graph is drawn, as shown in Figure 5. The dotted line here is again a tangent drawn at the point in which we are interested, namely, 0.5 mm. filter. In 0.5 mm. the ordinates of this tangent change from 27 to 0.5, *i.e.*, 26.5 units, which represent a change per centimeter of 530 units. The root mean square absorption coefficient variation is simply the square root of this quantity, or 23.1. The scatter coefficient for Cu being 0.5 (Al —0.15; tissue —0.18), we may calculate the homogeneity measure immediately.

Homogeneity =

$$0.21 \times \sqrt[6]{(23.1 \div [15 - 0.5])} \\ = 0.25 \text{ \AA. unit.}$$

If a homogeneity coefficient of the type of a ratio is desired it can be gotten from this homogeneity measure by taking the ratio of the sum of the effective wave length and the homogeneity measure to the effective wave length. In this case the homogeneity ratio so defined is 2.2.

The important point to be emphasized in connection with the measure of homogeneity here proposed is that it is derived from the rate of change of average absorption coefficient with filter thickness which is numerically equal to the mean square of the absorption coefficient variations. This is a definite connection between the absorption curve and the spectral distribution which will be proved in Part II independently of any questionable assumptions as to the form of the spectrum, and is pointed out here, it is believed, for the first time. The measure of homogeneity here proposed has a definite spectral significance, being the cube root of the root mean square variation of the cubes of the wave lengths present from the cube of the effective wave length.

It may be objected that the method of determining the homogeneity measure carries

with it much room for inaccuracy. The answer to this objection lies in the fact that in determining the homogeneity measure the sixth root of the slope of the curve of average absorption coefficient is taken. Under these circumstances the percentage error of the result is only one-sixth of the percentage error in the slope of the tangent, so that considerable inaccuracy in the latter will hardly affect the result.

In this connection it may also be pointed out that, since the homogeneity measure in the proper units is for most practical cases bound to be less than unity, its sixth power will be very small numerically. When it is noted that the logarithmic absorption curve as usually drawn has an abscissa scale in tenth millimeters, the reason for the approximate straightness of that curve is evident.

PART II

We now proceed to establish mathematically the truth of the various general statements made in Part I. The derivations are based upon no questionable assumptions as to the form of the spectrum, but only upon such fundamental physical laws as the law of exponential absorption for monochromatic radiation. Certain results with regard to independence of material are based upon the validity of Richtmyer's law, namely, that the absorption coefficient for any material is equal to the sum of a constant scatter term and a term proportional to the cube of the wave length. Results which depend upon this law, the accuracy of which may be questioned for very short wave lengths, are marked with an asterisk (*). In any case this law holds fairly well throughout the range of interest here, so that a close validity may be attributed to such results.

SYMBOLS

λ = Wave length in Ångström units
 ν = Frequency in vibrations per second

μ = Absorption coefficient in reciprocal centimeters

I_λ = Intensity of radiation per unit wavelength interval

I_ν = Intensity of radiation per unit frequency interval

I_μ = Intensity of radiation per unit absorption coefficient interval, *i.e.*, for a wave

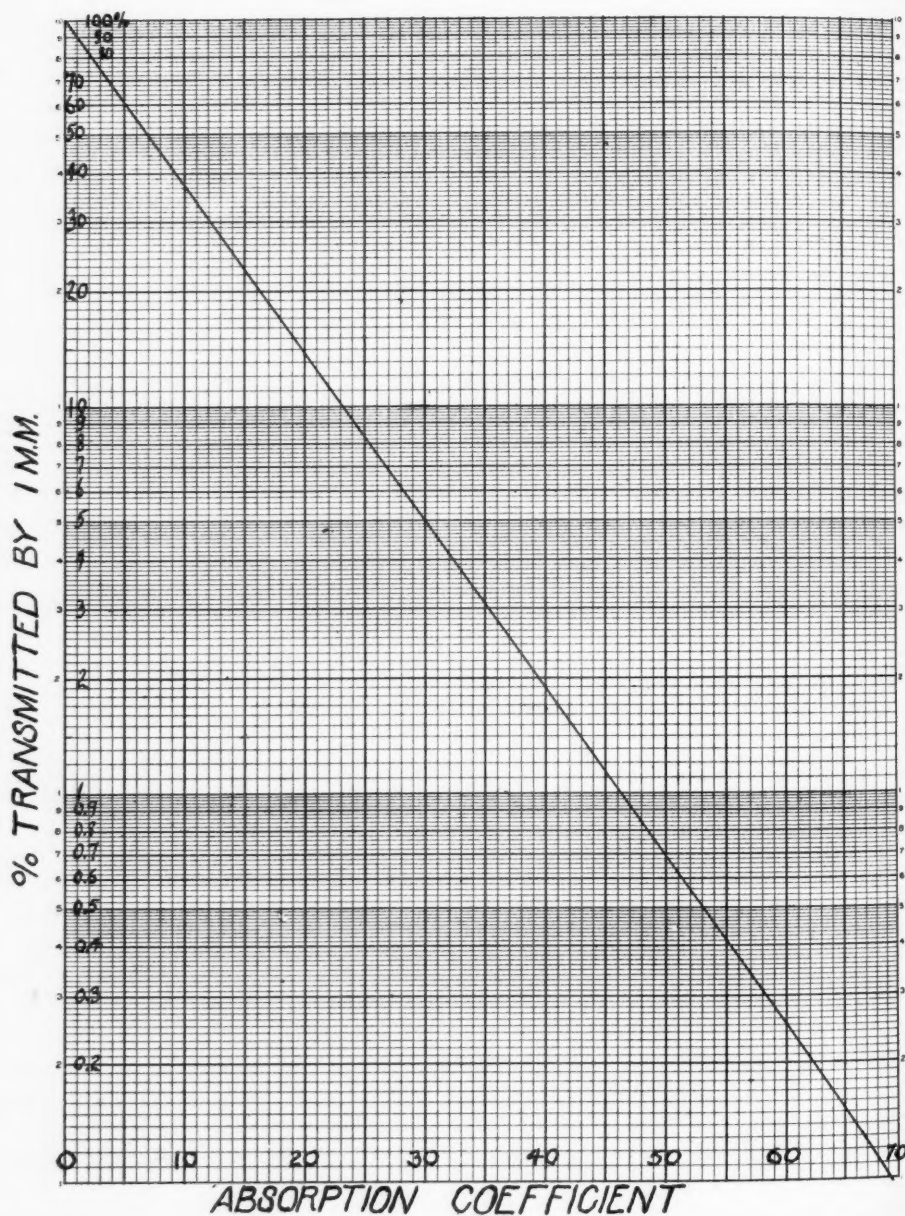


Fig. 4. Graph showing the percentage transmitted by one millimeter for different absorption coefficients.

length interval corresponding to a difference of unity in absorption coefficient

f = Initial filter thickness in centimeters

x = Supplementary filter thickness in centimeters

A and B = The constants in Richtmyer's law, $\mu = A\lambda^3 + B$.

Effective or average values will be indicated in the usual way by means of overlining the quantity whose average or effective value is to be shown.

MATHEMATICAL FORMULATION OF METHODS I, II, AND III

The total intensity coming from the source of radiation through the filter of thickness f is given by:
$$\int_0^\infty I_\mu e^{-\mu f} d\mu$$

The total intensity coming through with an additional filter of thickness x interposed is evidently:
$$\int_0^\infty I_\mu e^{-\mu(f+x)} d\mu$$

It follows from the three definitions for effective wave length that this wave length is to be determined from an effective absorption coefficient determined by the equation:

$$e^{-\bar{\mu}x} = \int_0^\infty I_\mu e^{-\mu(f+x)} d\mu \div \int_0^\infty I_\mu e^{-\mu f} d\mu \quad (1)$$

In Method I, x is fixed.

In Method II, x is selected so that $e^{-\bar{\mu}x} = 1/2$.

In Method III, x approaches zero.

It follows at once that the results for the three methods will differ except in very special cases.

MATHEMATICAL FORMULATION FOR METHODS A, B, C, AND D

Method A:

$$\bar{\lambda} = \int_0^\infty I_\lambda e^{-\mu f} \lambda d\lambda \div \int_0^\infty I_\lambda e^{-\mu f} d\lambda \quad (2)$$

Method B:

The average wave length is that corre-

sponding to the average frequency, given by:

$$\bar{\nu} = \int_0^\infty I_\nu e^{-\mu f} \nu d\nu \div \int_0^\infty I_\nu e^{-\mu f} d\nu \quad (3)$$

Method C:

The average wave length is that corresponding to the average absorption coefficient:

$$\bar{\mu} = \int_0^\infty I_\mu e^{-\mu f} \mu d\mu \div \int_0^\infty I_\mu e^{-\mu f} d\mu \quad (4)$$

Method D:

The average wave length is that corresponding to the average frequency weighted according to the number of quanta:

$$\bar{\nu} = \int_0^\infty I_\nu / h\nu \cdot e^{-\mu f} \nu d\nu \div \int_0^\infty I_\nu / h\nu \cdot e^{-\mu f} d\nu$$

POSSIBILITY OF EXPERIMENTAL REALIZATION OF METHOD A

As suggested in Part I, the average wave length can be found if an ionization chamber can be arranged to give readings proportional to wave length. This can be accomplished by interposing between the source and an air chamber a slit of variable width covered by a filter of variable thickness, so that the thicker parts are over the narrower parts of the slit. Because of the widening of the slit the effect of higher wave lengths will be accentuated. If "w" is the width of the slit at a point "y" along its length, total length "l," and "t" the filter thickness at the same point, the readings of the ionization chamber for radiation of wave length λ will be proportional to

$$\int_0^l w e^{-\mu t} dy.$$

If "w" and "t" as functions of "y" are determined from the equation

$$\lambda = K \int_0^1 w e^{-\mu t} dy,$$

with positive "K," the required conditions are met, and the ratio of values so found to those found with an appropriate air chamber will be the average wave length.

For the possibility of a physical realization of this scheme the quantities "w" and

"t" must satisfy certain auxiliary conditions: "t" must be positive throughout its range. If "w" must be negative at any part of its range, the ionization chamber would have to be divided into two parts, with provision for an effective subtraction of the currents produced in that part corresponding to the negative values of "w." That such negative values for "w" must arise may be seen from the fact that, no matter how the wedge be shaped, its transmission must be greater for shorter wave lengths. We desire the current to be greater for longer wave lengths. Hence, there

must appear negative values for "w" to compensate.³

EQUIVALENCE OF METHODS A AND D

If c/λ be substituted for ν in the definition of $\bar{\nu}$ in Method D, and noting that $I_\nu d\nu = I_\lambda d\lambda$, it is immediately evident that the result is the same as $c/\bar{\lambda}$. This indicates that the two methods are equivalent. The number of quanta present in the radiation is evidently $E/h\bar{\nu} = E\bar{\lambda}/hc$ where E is the total

³The mathematical form of this problem is closely related to that solved by Christen in the design of a true energy-measuring ionization chamber. (Physikalische Zeitschrift, 1917, XVIII, 165, and 1915, XVI, 362.)

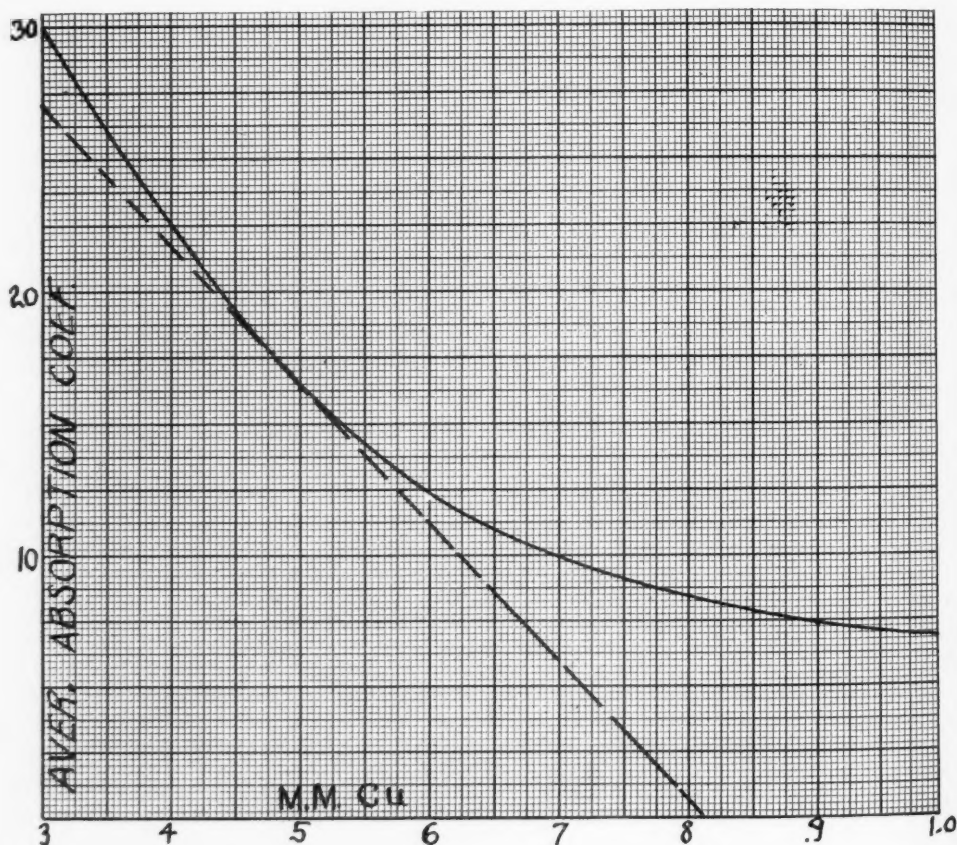


Fig. 5. "In order to find the measure of homogeneity the average absorption coefficients are found for all the tangents drawn, and a graph is drawn. . . . The dotted line here is again a tangent drawn at the point in which we are interested, namely, 0.5 mm. filter."

energy in absolute units (Sauter) and $\bar{\lambda}$ is the average wave length of Method A or D.

EQUIVALENCE OF METHODS III AND C

For Method III, since x approaches zero, we may substitute $1 - \mu x$ for $e^{-\mu x}$ and $1 - \bar{\mu} x$ for $e^{-\bar{\mu} x}$ in Equation (1). This equation then reduces to Equation (4), proving the equivalence of the two methods.

INDEPENDENCE OF RESULT OF METHODS III OR C OF MATERIAL*

Noting that $I_\lambda d\lambda = I_\mu d\mu$ and substituting the expression for Richtmyer's law for μ and $\bar{\mu}$ in Equation (4) this reduces to

$$\bar{\lambda}^3 = \int_0^\infty I_\lambda e^{-\mu f} \lambda^3 d\lambda \div \int_0^\infty I_\lambda e^{-\mu f} d\lambda, \quad (5)$$

showing that the effective wave length so determined is independent of the coefficients of Richtmyer's law, and hence of the material used in measurement. μ still appears, but only in connection with the filter of thickness f . The material of this filter certainly is of importance. We are not proving that the quality of filtered radiation is independent of the filter material, but that the numerical measure of the quality (effective wave length) is independent of the material used in the supplementary filters for the purpose of measurement. Equation (5) shows, in fact, that the cube of the effective wave length is equal to the average cube of the wave lengths present. This independence of material has been shown experimentally for rather thin filters by Quimby.⁴

If the same or similar transformations are attempted for Methods I or II, the Richtmyer coefficients cannot be taken out of the integrations and hence measurements made by these methods will depend on the material used (Duane).

SUFFICIENCY OF ABSORPTION CURVE AS DEFINING SPECTRAL DISTRIBUTION

The absorption curve or the functional

⁴E. H. Quimby: Am. Jour. Roentgenol. and Rad. Ther., January, 1929, XXI, 64.

relation between thickness of filter and transmitted intensity may be put in the form

$$\phi(x) = \int_0^\infty I_\mu e^{-\mu(f+x)} d\mu.$$

It is evident that I_μ determines $\phi(x)$ uniquely. Furthermore, $\phi(x)$ determines I_μ uniquely. This follows from the theory of Laplace transformations and is too complicated to be gone into here.

RELATION BETWEEN SPECTRAL WIDTH AND RATE OF CHANGE OF AVERAGE ABSORPTION

Differentiating both sides of Equation (4) with respect to f , we obtain:

$$\frac{d\bar{\mu}}{df} = \bar{\mu}^2 - \int_0^\infty I_\mu e^{-\mu f} \mu^2 d\mu \div \int_0^\infty I_\mu e^{-\mu f} d\mu.$$

The second term of the right member may be looked upon as the average square absorption coefficient. It may readily be shown that $\bar{\mu}^2 - \bar{\mu}^2 =$

$$\int_0^\infty (\bar{\mu} - \mu)^2 I_\mu e^{-\mu f} d\mu \div \int_0^\infty I_\mu e^{-\mu f} d\mu$$

$$\text{which gives: } -\frac{d\bar{\mu}}{df} = \overline{(\bar{\mu} - \mu)^2} \quad (6)$$

showing that the rate of decrease of the absorption coefficient with increasing thickness of filter is equal to the average square of the absorption coefficient variations from the average.

HOMOGENEITY MEASURE*

The function selected for the homogeneity measure is

$$\lambda \sqrt[3]{\overline{(\bar{\mu} - \mu)^2} \div (\bar{\mu} - B)}.$$

Its independence of measuring material and its dimensionality may be shown readily by substituting for μ and $\bar{\mu}$ their Richtmyer's law equivalents. We obtain

$$\lambda \sqrt[3]{\overline{(\bar{\lambda}^3 - \lambda^3)^2} \div \lambda^3} = \sqrt[3]{\overline{(\bar{\lambda}^3 - \lambda^3)^2}}$$

of the dimensions of a wave length and independent of material.

STRAIGHTNESS OF ABSORPTION CURVE

The logarithmic absorption curve appears experimentally rapidly to approach a limit-

ing slope, other than that corresponding to the minimum wave length. That this cannot be a real effect is shown by Equations (6) and (4). The slope of the logarithmic absorption curve cannot be constant unless the radiation is monochromatic. From the form of Equation (4) it is evident that for large "f" only the smallest values of μ present in the radiation will contribute. Hence the limiting value must be the minimum absorption coefficient corresponding to the quantum limit of the radiation.⁵

SUMMARY

A mathematical study of the various methods of quality measurement is presented. It is proved that the method depending upon the slope of the logarithmic absorption curve is unique in that it is the only method yielding a value independent of the filter material used in obtaining it, and having a definite significance with respect to the spectrum. Certain types of theoretical average wave lengths are discussed, partic-

ularly a method is proposed but not worked out in detail for finding the average wave length corresponding to the average quantum frequency or energy per quantum.

A new definition of a homogeneity measure is given. The quantity so defined may be found by calculation from the data necessary for finding the effective wave length by the method of choice. This quantity has a definite spectral significance and does not depend on spectral or voltage measurements.

It is pointed out that the apparent ultimate straightness of the logarithmic absorption curves is closely related to the slow change in spectral spread with increasing filter, and that the curve cannot be truly straight but must continue to change its slope until it corresponds to the absorption for wave length equal to the quantum minimum wave length.

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⁵L. S. Taylor: *RADIOLOGY*, March, 1931, XVI, 302.

FOCAL SPOT PROJECTION AND THE POSITION OF THE X-RAY TUBE IN RADIOGRAPHY

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MODERN roentgenography is conspicuous for its inability to stabilize and standardize technical procedures. Reduced to essentials, this is due to failure to measure and control within reasonably close limits the various physical factors involved.

The technical characters of an X-ray film may be described as having two essential bases: first, the *geometric projection* of the shadows onto the film, and secondly, the *qualitative reproduction* of these shadows in the emulsion. Satisfactory management of both of these factors is indispensable to high grade roentgenography.

The qualitative reproduction of projected shadows is in the main a matter of securing contrast between densities. This, in turn, resolves itself into questions, first, of the control of penetration, and secondly, of the management of non-geometric radiations, *i.e.*, the radiations scattered from the tissues, *et cetera*, and those from intensifying screens. Processing of films is also concerned with the maintaining of contrast.

As to the geometric projection of shadows, this should be relatively simple to analyze and control, although to our knowledge such data have not been presented to the roentgenologist. Thus, the shadows projected from a given object bear simple relations to the size of the object, to the object-film and target-film distances, and to the size, shape, and position of the source of the radiations, *i.e.*, the focal spot. It must be the aim of the roentgenologist to have these shadow projections reproduce as closely as possible the size and shape of the causative object, and with the greatest pos-

sible sharpness. To attain such ends the geometric characters of the shadows, in *terms* of the causative object, must be capable of simple determination and control. When these are attained, the satisfactory *qualitative* reproduction of the shadows is a further problem, but one which must not be confused with the first.

The present study constitutes a first step in the mensuration of shadow-projections, and relates to the effects of the position of the focal spot of the X-ray tube with respect to the film. From the data so obtained, suggestions are offered for the placing of the tube in order to attain maximum fidelity of shadow-production.

NATURE OF FOCAL SPOT PROJECTION

It is, of course, generally recognized that a large focal spot produces under given conditions a less satisfactory degree of sharpness and radiability than does a smaller focal spot. It is less generally recognized, however, that a given focal spot, in the type of X-ray tube in current use, varies widely in its *effective* size over different parts of a film. It follows that those radiographic characters which are influenced by focal spot size, namely, sharpness of shadow and the radiability of fine objects, are also variable over different parts of a film.

The variable effective size of a focal spot may be expressed as "variable focal spot projection." By "focal spot projection" we mean the parallel line projection of the focal spot upon the film. (See Diagrams I and II.) Diagram I depicts the focal spot projection in the lateral axis of the tube. In this

direction the axis of the focal spot is parallel to the film. Under these conditions, the focal projections at the points A, B, and C are of constant size and equal to the dimen-

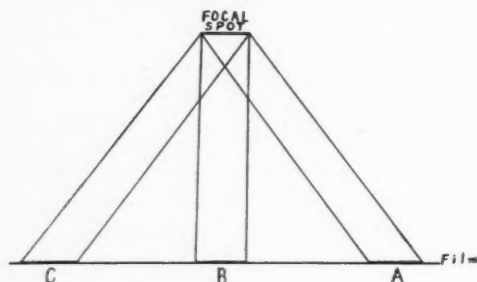


Diagram I.

sion of the focal spot. In Diagram II, in the long axis of the tube, the axis of the focal spot is not parallel to the film, and projection conditions are quite different. The projection at B represents the usual central ray focal spot measurement, and is much smaller than the actual focal spot dimension. The projection at the cathode end of the film (C) is much larger than the central ray projection, and at the anode end of the film (A) the projection is much smaller. In Diagram II an attempt has been made to depict the *total* projection of the focal spot, i.e., the projections in *all* directions. The dotted lines represent the uniform projections in the lateral axis of the tube (see Diagram I), and the elliptical figures show the total projections in all directions (in the case of the usual elliptical focal spot).

If parallel lines are projected from all points around the circumference of an elliptical focal spot, the resulting projection figure at any point on a film is invariably a true ellipse. The relative dimensions of such ellipses vary with the film position, as shown in Diagram III, as well as with the dimensions of the film, target-film distance, and angle of slope of the anode. The dis-

tribution of such ellipses over a film is shown on a large scale in this diagram for a 45° slope of anode. The figures given represent percentage of central ray projection

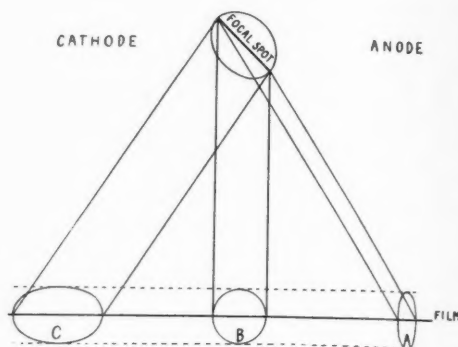


Diagram II.

under the conditions noted. These ellipses are thus the images actually cast upon a film when exposure is made through minute round holes in a sheet of metal placed midway between the focal spot and the film. Furthermore, the elliptical projection figure at any point represents the *effective* shape and size of the focal spot with which an object is radiographed upon that part of the film.

Although sharpness of shadow and radiability (i.e., the ability to produce a satisfactory shadow of detailed structures) are functions of the effective size of the focal spot, *actual* sharpness and radiability depend also upon the ratio of the object-film to the target-object distance, upon the ratio of the size of the object to the size of the focal projection, and also upon the quality of photographic reproduction. Thus sharpness and radiability are *potential* only so far as the focal spot projection is concerned, the actual shadow characters depending also upon other factors, as indicated above.

The following mathematical methods give the dimensions and slope of the elliptical projection figure at any point on a film for a 45° slope of anode.

thus obtained, an ellipse is inscribed. This ellipse is the projection of the focal spot at that point. Such quadrilateral projections and their inscribed ellipses are shown at the

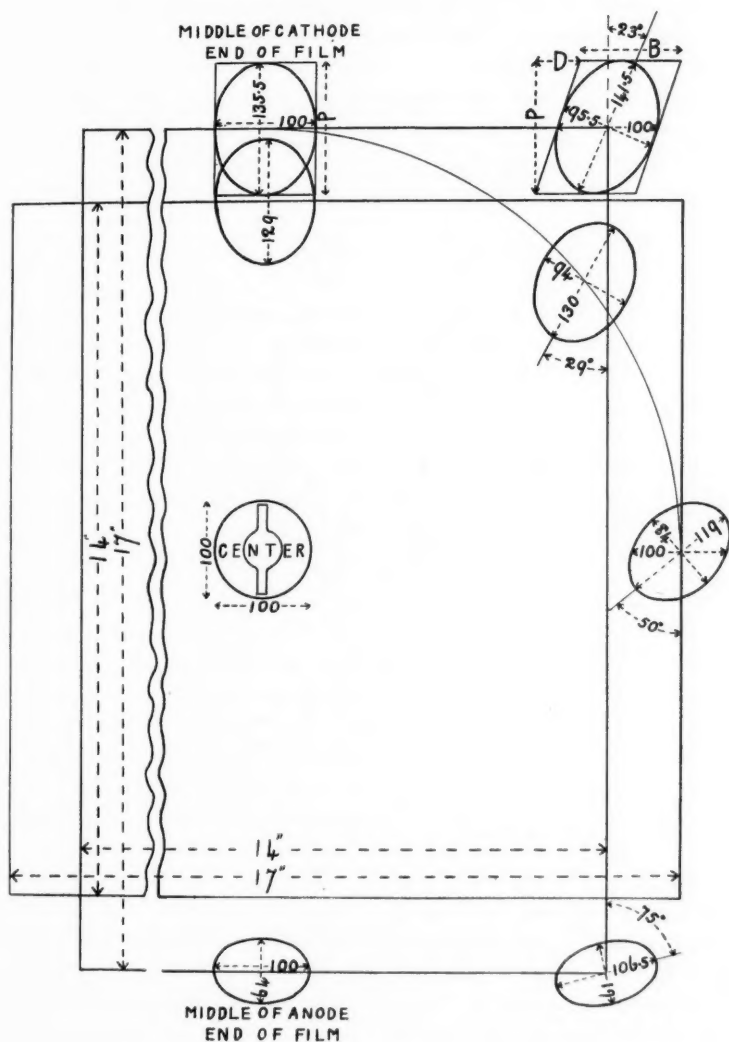


Diagram III.

The focal spot is circumscribed by a rectangle which, in turn, is projected by parallel lines upon the desired point on the film. Within the quadrilateral projection figure

cathode end of the film in Diagram III. Along the mid-axis of the film, *i.e.*, the line perpendicularly below the long axis of the tube, the quadrilateral figures are rec-

tangles. The length of these rectangles is easily calculated by triangulation, and the width is the width of the focal spot. At points away from the mid-axis of the film, the quadrilateral projection figure is a parallelogram on account of a sideways displacement D (see cathode corner projection, Diagram III), the size of which is

is the short axis of the ellipse. If, however, as in Diagram V, the edge to be radiographed does not coincide in direction with the main axis of the ellipse, the effective focal projection at the point P is not the diameter of the ellipse $A' B'$, but is the larger dimension $C D$. This dimension is the distance between parallel tangents to the

$$\text{Diameter of central ray projection} \times \frac{\text{distance of point from mid-line of film}}{\text{target-film distance}}$$

The major and minor axes of the inscribed ellipse are given simultaneously by the formula

$$\sqrt{\frac{1}{2} [P^2 + D^2 + B^2 \pm \sqrt{(P^2 + D^2 + B^2)^2 - 4P^2 B^2}]}$$

where P is the projection at the opposite point on the mid-axis of the film, and D and B represent the displacement and base of the parallelogram, respectively (Diagram III).

The angle between the major axis of the ellipse and the mid-axis of the film is given by the following equation, where L is the major and S is the minor axis of the ellipse.

$$\text{Sine of the angle} = \frac{1}{B} \sqrt{\frac{L^2 (B^2 - S^2)}{L^2 - S^2}}$$

If the slope of the anode is other than 45° , corrections must be made to the dimensions and slope of the quadrilateral projection figure before applying the formulae for the inscribed ellipse.

DETERMINATION OF EFFECTIVE FOCAL SPOT SIZE AT ANY POINT ON A FILM

The effective focal spot size at any point on a film, and with reference to a linear structure of *fixed direction*, is determined—though not directly—by the dimensions of the projection figure at that point. These relations are shown in Diagrams IV and V. In Diagram IV, let the line $A B$ represent the edge of an object being radiographed, the edge coinciding in direction with the main axis of the elliptical projection figure. The focal projection, or effective focal spot size determining the width of the penumbral shadow at the point P , is then $A' B'$, which

projection figure in the direction of the edge being radiographed. This increased projection under these conditions is due to the fact, as shown in the diagram, that ellipses with centers at points on either side of the point P on the edge $A B$ will touch the tangents at C and D and thus increase the effective focal projection. The distance between parallel tangents to an ellipse is given by $\sqrt{L^2 \sin^2 \theta + S^2 \cos^2 \theta}$ where L and S are the major and minor axes of the ellipse, and θ is the angle between the major axis of the ellipse and the tangents.

The effective focal spot projection, or effective focal spot size, at any point on a line, is, then, the distance between parallel tangents to the projection figure, in the direction of that line.

In the practical radiography of detailed structures, however, sharpness is viewed at a given point or small area in multiple directions at the same time. If an object at any point is radiographed with an elliptical projection figure of, say, 135 units in length by 100 units in width, sharpness at that point also varies in different directions between these two values. We must, then, determine how to classify the resulting average or apparent sharpness (and focal spot size) at this point or area.

It is apparent that neither the maximum

nor the minimum sharpness at a point will dominate the net sharpness as visualized. It seems logical, then, to take as the *average* sharpness (and effective focal spot size) at a point or small area, the average distance between parallel tangents to the projection figure in all directions. Thus in the case of an elliptical projection figure of 135×100 units major and minor axes, the average distance between all parallel tangents is slightly more than 117.5 units. The average or effective focal spot size in this case may, then, be fairly placed at 117.5 per cent of the central ray projection. This hypothesis was examined experimentally, as follows: A small piece of bone containing detailed structure was radiographed first with an elliptical focal projection of 135×100 units, and then with a circular projection of 117.5×117.5 units. The visible effect as to sharpness was identical so far as the eye could judge under the two conditions. When isolated edges were radiographed with these maximum and minimum projection values under the same distance conditions, the difference in sharpness was obvious. This confirms for practical radiography the correctness of the above method of expressing effective focal projection at a point.

POINT OF MAXIMUM SIGNIFICANT PROJECTION OVER A FILM

It will be noted in Diagram III that the elliptical projections at all points other than on the main axis of the film slope outwards to varying degrees, and that the greatest projection at any point on a film is in the cathode corners. Here the maximum projection may exceed the central ray projection by over 40 per cent. As previously noted, it follows that sharpness and radiability on a film may be 40 per cent worse than the usual central ray focal spot measurement would indicate. Inasmuch, how-

ever, as the extreme corners of a film are not customarily the seat of important shadows, this maximum projection at the cathode corners is probably not of impor-

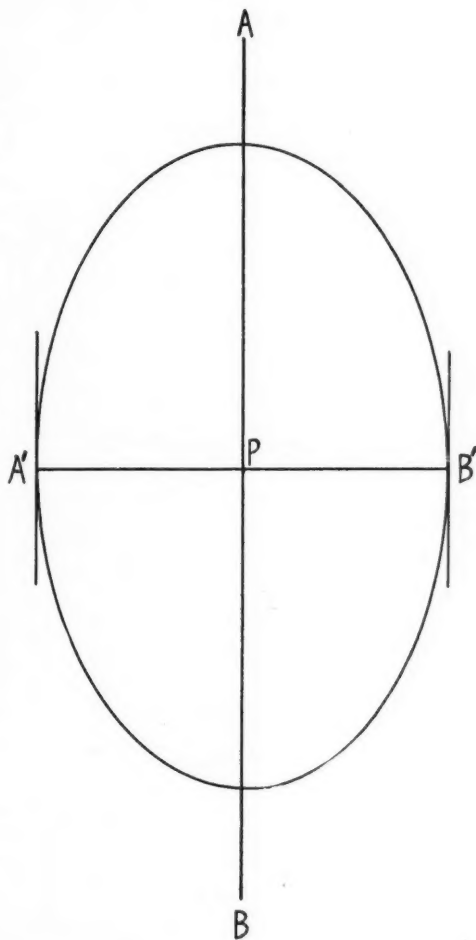


Diagram IV.

tance in practical radiography. It will be seen in the diagram that the maximum projections at all points on the arc of a circle traversing the middle of the cathode end of a film, and with center at the center of the film, are of approximately the same size. For purposes of classification or correction, therefore, it seems reasonable to accept as

the maximum significant projection over a film, the maximum projection at the middle of the cathode end of that film.

If focal spot measurements are to be used

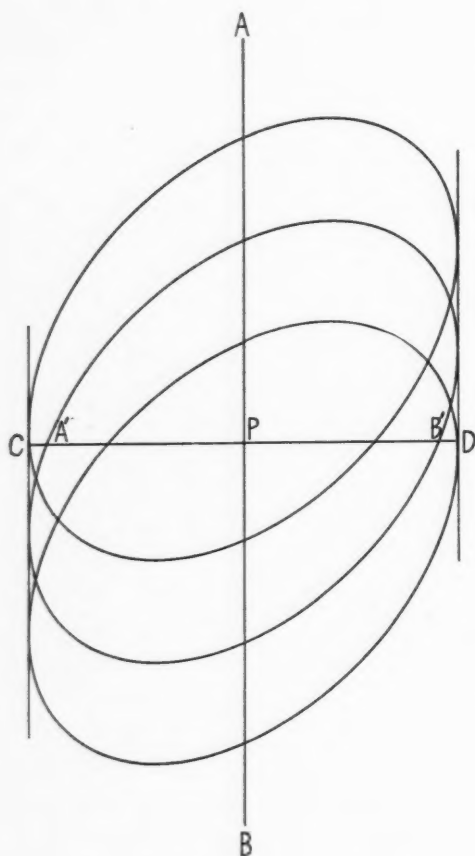


Diagram V.

as an index to those radiographic characters which are influenced by focal spot size, it is apparent that we must recognize this maximum significant projection over the film, in place of the usual central ray focal spot measurement.

Given, however, the conditions for an elliptical focal spot projection of 135×100 units at the mid-cathode end of the film, it would not be fair to classify the tube as

having an effective focal spot size of 135.0 units instead of the 100 units of the central ray projection, for the reason that only a limited number of linear structures in very limited directions will be radiographed by this maximum projection of the focal spot. It has been shown in the preceding section that the net effective size of the focal spot at any point of a film may be taken as the average distance between all parallel tangents to the projection figure at that point. In the case of ellipses within the size ratios of focal spot projections, the average distance between parallel tangents in all directions is very close to the average of the major and minor axes. This average may, then, be used for practical tube classification. In the above-mentioned example, where the largest projection figure at a useful point on the film (middle of the cathode end) is an ellipse 135 units long and 100 units wide, the focal spot should be classified as having an effective size of the average of these two dimensions, namely, 117.5 units. If the central ray projection, for example, actually measures 0.25 inch, the focal spot should be classified as having a useful size under these conditions of 117.5 per cent of this measurement, or 0.294 inch.

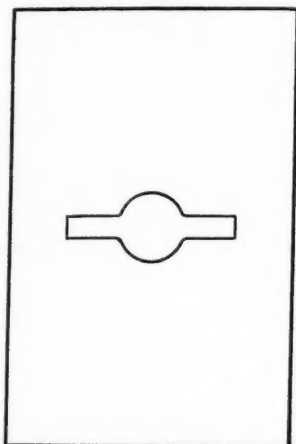
In the case of stereoscopy, the effective film length is increased by reason of the off-centering of the tube. Under the above conditions, when the tube is off-centered one inch (one-half of a two-inch trip), the effective focal spot size as defined in this study becomes 120 per cent of the central ray projection.

It might be argued that the central ray projection, being the average projection between the anode and cathode ends of the film, is representative of the average projection over the film. Although it is both logical and practical to take as the average or effective projection at a small area the average projection in all directions at that point, it must be remembered that the eye does not

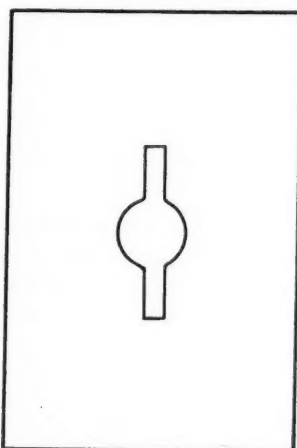
view a film as a whole but is capable of inspecting only a small area at a time. Consequently the effective sharpness and radiability as actually visualized are poorer over the entire cathode half of the film than the

central ray projection would indicate. In practice, therefore, it is not logical to classify the focal projection over a film as being that of the central ray projection. It is useless to have an acceptable degree of sharp-

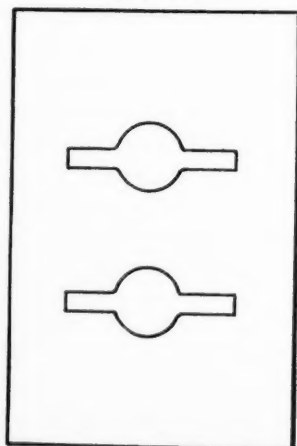
CORRECT
TUBE POSITION
OVER FILM



INCORRECT
TUBE POSITION
OVER FILM



CORRECT
STEREOSCOPIC
TRIP



INCORRECT
STEREOSCOPIC
TRIP

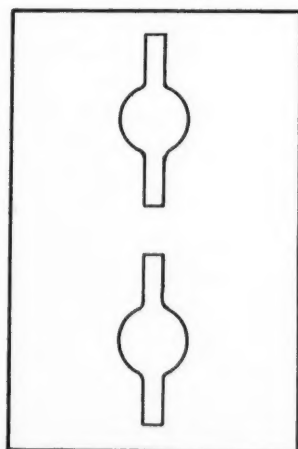


Diagram VI.

ness over the anode half of the film, and indecipherable shadows over the cathode half. The shadows over the worst useful part of the film must be diagnostically satisfactory. For purposes of tube classification, such classification having as its purpose the measurement and control of sharpness and radiability, the dimensions of the projection figure used must refer to the worst useful part of the film. This is the basis of the methods employed in this study.

PRACTICAL APPLICATIONS

The measurement of focal spot projection as analyzed in this study may be used in two very practical ways.

In the first place, a knowledge of the actually effective focal spot projections under the conditions in use is indispensable to the measurement and control of sharpness of shadow and for the production of shadows of fine objects (detail). Such measurement and control cannot be possible in a precise way with a knowledge only of the central ray projection of the tube. The application of the data to this problem is beyond the scope of the present study but will appear at a later date.

Secondly, the data give a basis for the positioning of the X-ray tube in relation to the film in order to obtain the maximum efficiency inherent in the tube under the conditions in use.

The following suggestions are offered by way of obtaining such maximum efficiency:

(1) The tube may be rerated as to focal spot size on a basis of the projection conditions actually in use. Such rerating does not, of course, alter the efficiency of the tube, but gives the operator a more accurate index of the sharpness and radiability he may obtain than does a classification based on the central ray projection.

As outlined in the foregoing sections, the actually effective size of the focal spot may

be taken as the average measurement between the long and the short axis of the elliptical projection figure at the middle of the cathode end of the film.

Such classification of elliptical focal spots in percentage of central ray projection, when covering varying film dimensions at varying distances, is given in Table I.

In the case of tubes in which the anode is placed at a higher slope than 45° (so-called line-focus tubes), a separate table would be necessary for each slope in order to reclassify them in terms of "effective" focal spot size as above. Figures for 18° anodes are included in Table I. The corresponding figures for any slope of anode may be readily obtained by substituting into the following formula:

Effective projection in percentage of central ray projection =

$$\frac{25 \times \text{film dimension}}{\text{target-film distance} \times \tan \theta} + 100$$

where θ is the angle which the anode makes to the perpendicular to the film, and "film dimension" refers to the total length of the film in the long axis of the tube, the target being centered.

It will be noted that the maximum effective projection over a film is a much greater percentage of the central ray projection in the case of the line-focus type of tube than in the 45° anode tube. Against this, however, is the fact that the area of the focal spot, and therefore capacity, is much greater in the case of the line-focus tube for equal central ray projections. The balance between these factors, then, must determine the relative merits of these designs of focal spots and will be analyzed in a later publication.

(2) It is apparent from Table I that the effective focal spot size over a film increases rapidly with the larger dimensions of film. This increased projection is, however, of importance only over the cathode

TABLE I.—CLASSIFICATION OF EFFECTIVE FOCAL SPOT SIZE IN PERCENTAGE OF CENTRAL RAY PROJECTION

Target-film distance	45° Anode Film length					18° Anode Film length				
	17-in.	14-in.	12-in.	10-in.	8-in.	17-in.	14-in.	12-in.	10-in.	8-in.
24-inch	118	115	113	111	108	160	145	139	132	126
30-inch	114	112	110	108	107	144	136	131	126	121
36-inch	112	110	108	107	106	136	130	126	121	117
42-inch	110	108	107	106	105	131	126	122	118	115
48-inch	109	108	107	105	104	127	123	119	116	113
60-inch	107	106	105	104	103	122	118	115	113	110
72-inch	106	105	104	104	103	118	115	113	111	108
84-inch	105	104	104	103	103					
96-inch	105	104	103	103	102					
108-inch	104	104	103	103	102					
144-inch	103	103	102	102	102					

end of the film. If, then, the long or anode-cathode axis of the tube is placed along the shortest dimension of the film, the maximum projection over that film is substantially reduced. This is especially important in stereoscopy, where the off-centering of the tube has the effect of increasing the film dimension. The correct and incorrect tube positions for single and stereoscopic exposures are shown in Diagram VI.

This simple expedient should invariably be employed in practical radiography, and especially when stereoscopic exposures are made. This applies to tubes with any slope of anode, and is especially important when line-focus tubes are used.

(3) A further method of lessening the film dimensions is to off-center the tube towards the cathode end of the film. This will result in lessened projection throughout the film. There are, however, important objections to this procedure. Anatomic landmarks are shifted from their usual film relations, and the anode end of the film may suffer from lack of radiation. If the long axis of the tube is placed along the short axis of the film, as recommended in Section 2, off-centering is definitely contra-indicated because of displacement and distortion of shadow. If, for any reason, this latter positioning is not done, the tube may be off-

centered towards the cathode end of the film only, in the case of single exposures, to the extent of one-half the normal stereoscopic trip. This is desirable in the case of line-focus tubes when the tube is placed at sufficient distance from the film, but of doubtful merit when 45° anodes are concerned.

(4) If the tube is tilted so that its anode end is placed nearer to the film than the cathode end, improvement in projection conditions results. This is shown to an exaggerated degree in Diagram VII, in which X is the position of the focal spot when the tube is parallel to the film, and A its projection at the cathode end of the film. If the anode end of the tube is brought nearer the film, the focal spot rotates to the new position X', and the new projection at the cathode end of the film becomes A'. By a suitable degree of tube tilt, this new projection at the cathode end of the film may be made to approach the original central ray projection at B, *i.e.*, give a circular projection as shown in the diagram. Since this is the basic projection throughout the film in the lateral plane of the tube and is an irreducible minimum, it is apparent that if we can bring the maximum projection in the long axis of the tube to this level, we will have secured the smallest maximum projection that is possible with this design

of anode. Sharpness will be at a maximum, and distortion of shadow at a minimum, for the conditions in use. Table II shows the degree of anode tilt of the tube necessary

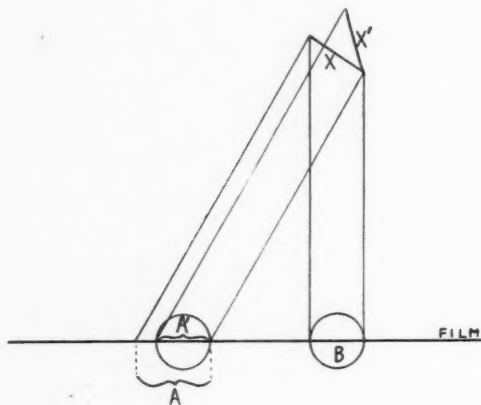


Diagram VII.

to reduce the projection at the cathode end of the film to that of the central ray projection. Tilted in this way, tubes may then be fairly classified in terms of the central ray or usual focal spot measurement. The method is applicable only to the 45° slope of the anode, and must not be used in the case of line-focus tubes.

The positions blocked off with the heavy line in the upper right-hand corner of Table II should be avoided when possible. In these positions the ratio of maximum to minimum projection over the film is unduly disturbed. In the positions in which the degree of tilt is qualified with the word "only," density cannot be obtained at the anode end of the film if greater tilt is used. These latter conditions need not be used in modern radiography. To attain maximum tube efficiency, the tilting of 45° anodes should be combined with the use of the shorter dimension of the film, as recommended in Section 2.

It is unwise to overtilt the tube. The

TABLE II.—ANODE TILT TO OBTAIN
MAXIMUM TUBE EFFICIENCY

Target-film distance	Film dimension					
	8"	10"	11"	12"	14"	17"
24-inch	10°	13°	14°	16°	13° only	5° only
30-inch	8°	10°	12°	13°	14°	12° only
36-inch	7°	8°	9°	10°	12°	15°
42-inch	6°	7°	8°	9°	10°	13°
48-inch	5°	6°	7°	8°	9°	11°
60-inch	4°	5°	6°	6°	7°	9°
72-inch	3°	4°	5°	5°	6°	7°

APPLIES TO 45° ANODE TUBES ONLY

maximum projection over the film is not lessened, and increased distortion of shadow results, while the anode end of the film may suffer from lack of radiation.

Modern tube stands are graduated at five-degree intervals to allow tilting in two planes. The intermediary angles may be readily estimated to the nearest degree. It is important that the tube be placed parallel to the film (by measurement to centers of glass arms) when the angle adjuster reads zero.

RESULTS

The gains that may be effected by adopting the procedures recommended in the preceding sections may be best illustrated by an example. If a tube with 45° slope of anode is placed in the usual position over a 10×12 inch film, *i.e.*, the tube parallel to the film, the target centered, and the long axis of the tube along the 12-inch dimension, the effective projection over the film as defined in this study at 24-inch target-film distance is 113 per cent of the central ray projection (Table I). If the tube is turned across the short axis of the film and the anode arm of the tube tilted 13° towards the film (Table II), the effective projection is, then, the same as the central ray projection of the tube, *i.e.*, 100 units. The improvement in projection is thus 13 per cent, giving a 13 per cent improvement in potential sharpness

and radiability at no cost whatever to the user.

Even this figure is not, however, fully representative of the gains so attained. With the tube remaining parallel to the film it would be necessary to increase the distance from the target to the object by almost 13 per cent in order to obtain this 13 per cent increase in sharpness. The increase in target-film distance would be less than 13 per cent, depending on the object-film distance in use. For a 3-inch object-film distance and 24-inch target-film distance, for example, it would be necessary to increase the target-film distance by exactly 10 per cent to attain a 13 per cent increase in sharpness at the cathode end of the film. The

new exposure would be $\left(\frac{110}{100}\right)^2$, or an increase of 21 per cent. By adopting these procedures, then, the capacity of the tube has been increased by this amount. There is no measurable diminution in the intensity of the radiation if the recommended angles of tilt are not exceeded.

Conversely, the tube could be placed nearer to the film with lessened exposure, while retaining the original sharpness. Under the conditions given above, the target-film distance could be lessened by 9.6 per cent with a decrease in exposure of 18 per cent. It is desirable in practice, however, that the energy gains so attained be used to improve sharpness and radiability rather than to conserve equipment by lessening the tube distance. This gain in energy as a gratuity for care in positioning of the tube would seem to be very well worth while.

The general formulæ for obtaining these values could be given. They would not, however, be applicable to practical radiography pending a definition of the term "object-film distance." This dimension is, under practical conditions, a composite value, and must be convertible into "effective

object-film distance" before the formula can be applied, a matter which is beyond the scope of this paper.

In the case of line-focus tubes, the tilting of the anode is already accomplished and cannot be carried farther by the user.

The gain in potential sharpness and radiability by placing the tube along the shortest axis of the film may be seen from the right-hand side of Table I for this particular slope of anode (18°). Thus the lessening in effective focal spot size by turning such a tube from the 17-inch to the 14-inch length of a film, is 160 minus 145, which is 15 units, or over 9 per cent. This also is an appreciable improvement, which is attained at absolutely no cost to the user.

DISCUSSION

L. S. LANDAUER, PH.D. (Chicago): I wish to thank Dr. Andrus for his very able presentation of a subject, which, to my knowledge, has not before been handled in a quantitative fashion. The qualitative factors have long been used in practice, namely, to increase detail, use the smallest possible focal spot at the longest possible distance, with the object as close as possible to the film. However, to set this up in a simple mathematical statement is a distinct contribution to the technic of radiology.

Detail, or sharpness, is dependent on several other factors not mentioned by Dr. Andrus. The first and most important of these is screen contact. Poor screen contact can do at least as much to ruin detail as can a large focal spot. Our methods of determining screen contact at the present time are crudely qualitative, to say the least. It would seem to me that a mathematical evaluation of screen contact, comparable to the essayists' evaluation of the effect of focal spot and distance, would be another distinct contribution in this same field.

A secondary factor in detail is contrast.

Detail *per se* is a function of focal spot size, tube film distance, and object film distance only (neglecting screens). However, all of the detail on the film can be lost if the density or the contrast of the finished film is poor. There is a current saying, the origin of which I do not know, to the effect that "Contrast makes detail more plainly visible." This phrase has considerable meaning. If a film is lacking in contrast, no amount of film-target distance will help the detail, and no focal spot, however small, will give good detail. Assuming the best possible conditions of focal spot and distance, giving almost perfect detail from a geometric standpoint, the detail from a visibility standpoint may be entirely lacking due to poor contrast. Contrast must be correct before detail will show. The same holds true, of course, for the density factor.

The size of the focal spot of every X-ray tube should be measured photographically. I would like to give a word of caution about this procedure. Assuming equal distances between the target and pinhole, and pinhole and film, the resultant pinhole image of the focal spot will be equal to the actual focal spot only if the pinhole is a mathematical point. As the size of the pinhole approaches the size of the focal spot, there are more and more spreading images impressed on the film, until when the two are of equal size, the size of the photographic image will be three times that of the actual focal spot. With a large focal spot an ordinary pinhole will give sufficiently accurate results; with a very fine focus tube, such as the 5-10 radiator tube, an ordinary pinhole may give quite inaccurate results, and special precautions should be taken to drill a very fine hole in the lead.

We very frequently find focal spots in which the energy is unevenly distributed, most frequently on an annular ring, instead of on a disc. Such a focal spot would, of course, have an effective size corresponding

to the external diameter of the annular ring, but an energy-radiating power of less than that which could be expected from a spot of such diameter. From geometric considerations, such a focal spot would not affect the umbral shadow, but would cause striations on the penumbral shadow, which, in turn, might affect the sharpness of the viewed image. I would like to ask Dr. Andrus whether or not he has conducted any experiments along this line.

From a practical standpoint, I have for some time adopted as a standard of sharpness that definition produced by a 5-10 radiator tube (focal spot not larger than 10/64ths) at a distance of 25 inches, with no screens. Assuming a 1½ inch effective object distance, and a focal spot of 9/64ths inch, the effective penumbral width would be

$$\text{Pen } 1\frac{1}{2} \times \frac{9/64}{23\frac{1}{2}} = 0.009 = \frac{9}{1000}$$

This comes within Dr. Andrus' classification of good. To preserve this sharpness with screens, it is necessary to go to a 36-inch distance. To preserve this sharpness with tubes other than the 5-10 and with screens, the following distances must be used:

5-10	36
5-30	52
5-100	80
F-F	77
M-F	92
B-F	116

The values of these distances are quite astonishing, and give some idea of the loss in detail occasioned when fine, medium, and broad focal spot tubes are used at short distances.

DR. ANDRUS (closing): No, I think I have nothing more to say, except that this demonstrates very clearly that the bands we have described are not the result of focal spot distribution.

RADIATION THERAPY IN THE TREATMENT OF CANCER OF THE MOUTH AND LIPS¹

By J. M. MARTIN, M.D., F.A.C.R., Professor of Radiology, Baylor Medical College
DALLAS, TEXAS

IN discussing the subject of cancer of the mouth and lips, I am covering well-trodden ground. This field has been, prior to the advent of radiotherapy, the exclusive heritage of the surgeon. Although

the mouth without clinical evidence of metastases and without previous treatment, Simmons (1), reporting for the American College of Surgeons, has claimed 35 per cent of cures for three or more years. Where

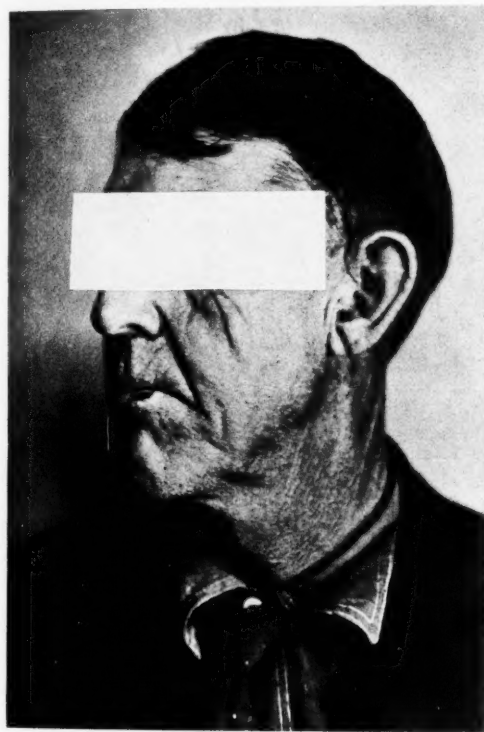


Fig. 1-A. A typical example of cancer of the lower lip in the first stage.



Fig. 1-B. Same case. The condition of the lip six months after X-ray treatment. The lip is perfectly well after eight years.

operation by excision is ages old, reliable surgical statistics regarding the results of treatment of cancer of the mouth and lips have not frequently appeared in the literature. In early primary cases of cancer of

there was clinical evidence of metastases only 5 per cent of the cases were cured.

In the surgical treatment of cancer of the lower lip, Sistrunk's (2) results are probably the most promising. In 93 cases operated upon before clinical evidence of lymph node involvement, 90.3 per cent were alive

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.



Fig. 2-A. Cancer of the lower lip in the second stage. The subcutaneous tissues were invaded but the glands were not involved.

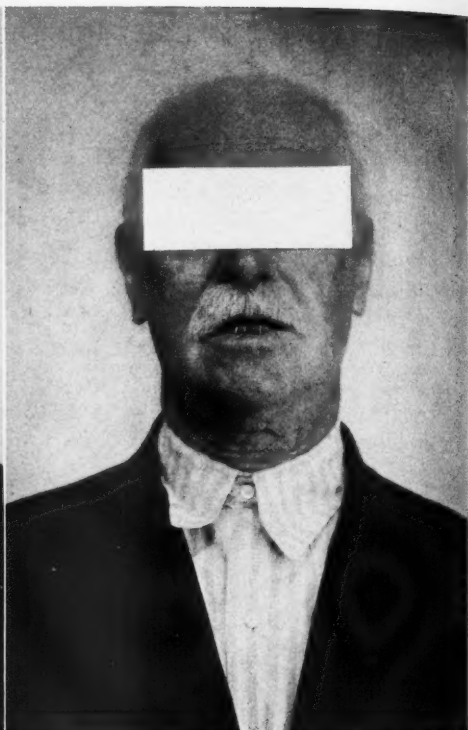


Fig. 2-B. Same case. Condition of the lip one year after X-ray treatment. There has been no evidence of recurrence after nine years.

after five and eight years. However, in eleven cases there was a recurrence in the site of the primary lesion, and three recurred in the glands, all of which were re-

operated upon. Two of the latter showed evidence of recurrence at the time the article was written. The operation consisted in removing a V-shaped piece from the lower lip

Ages	No. of cases	Well 5 years	Relapsed	Improved, not cured	Died from cancer	Died from other causes	Males	Females	Living
20 to 30	9	9	0	0	0	1	9	0	8
30 to 40	30	28	0	2	2	3	28	2	25
40 to 50	40	38	2	2	2	4	38	2	34
50 to 60	22	16	2	6	6	4	20	2	12
60 to 70	13	11	0	2	2	6	13	0	5
70 to 80	5	2	0	3	3	0	5	0	2
Total	119	104	4	15	15	18	113	6	86
Per cent		87	3	12	12	15	95	5	71

Table I. A general survey of a group of 119 cases of cancer of the lower lip treated by X-rays and followed for a period of five years.



Fig. 3. Carcinoma of the lip in the third stage. Besides the extensive lip lesion, the submental, submaxillary, and cervical lymph nodes on both sides were involved. This case was not treated.

and dissecting out the glands draining the lip and chin. In a group of eleven cases having metastases in the glands of the neck at the time of the operation, 18.1 per cent were alive after five years. There was one local recurrence in the primary lesion and three in the glands of the neck. On six of the eleven cases a block dissection was done which included removal of the submaxillary and submental lymphatics. Five of this group died, with one living five years and three months. In the remaining five cases a block dissection was not done; only the involved glands were removed. Four patients are dead and one is alive after five years and eight months. Two cases out of the eleven (18.1 per cent) survived the disease and the operation.



Fig. 4. Squamous-cell carcinoma, Grade 2, in the right cheek of a persistent smoker. No glands in the neck. Seven 0.6 mg. platinum radium needles were sewn under the edges of the lesion for seven days. One 25 mg. radium capsule filtered with 1 mm. brass, 2 mm. lead, and 1 mm. rubber was held against the lesion for eight hours.

In comparison with the foregoing surgical results it will be interesting to note that Duffy (3) has reported 271 cases of cancer of the lower lip admitted for treatment at the Memorial Hospital in New York, over a period of seven years. Of these, 90.1 per cent (or 210 cases) had no

Stages	No. cases	Primary lesions healed	Secondary lesions	
			Inflamed	Malignant
			Healed	Died
First	86	86	None	None
Second	22	18	6	4
Third	11	7	None	11
Total	119	111	6	15

Table II. Grouping the 119 cases into the three stages, with end-results. By omitting the 11 cases in the third stage which were incurable, 108 cases remain. Four of these patients died later from cancer. Of the cases in the first and second stages, 104 (or 96.3 per cent) were well for five years.



Fig. 5. The same case illustrated in Figure 4, two months later. A slight puckering of the mucosa is the only evidence of the growth.

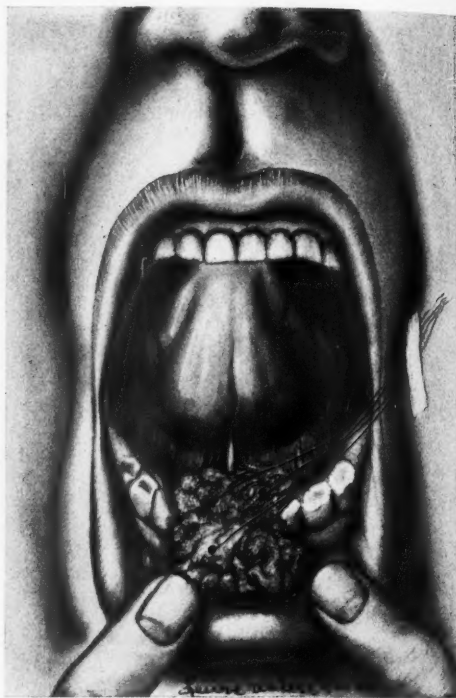


Fig. 6. Squamous-cell carcinoma of the alveolar margin. Four 0.6 mg. platinum radium needles were introduced and sewn deep in the tumor for seven days.

neck surgery done and showed no evidence of metastases during the period of treatment and observation.

In our series of 218 cases of cancer of the lower lip seen and treated by radiation therapy in private and hospital practice over a period of nine years (1906 to 1925), 119 cases are reported because we have a complete follow-up on each case for from five to ten years. Of the 119 cases, 104 never metastasized at any time during the period of observation. Table I summarizes this group of cases as follows: The number of cases occurring in each of the ten-year periods from 20 to 80 years of life; the number well after five years, the number that relapsed, the number that improved but were not cured, the number dying from cancer and from other causes; the number of males and females and the number living in each of the ten-year periods.

It is our custom to group all cases of cancer of the lower lip into three stages

which, of course, have no boundary lines and the stages may occasionally overlap each other. In the first stage (Fig. 1) is grouped all cases in which the lesions are confined to the superficial tissues, that is, to the mucocutaneous structures proper. The second stage (Fig. 2) includes all lesions that have become more extensive, with the induration and ulceration more pronounced and the subcutaneous structures involved without evidence of glandular invasion. In the third stage (Fig. 3) are included all cases in which the lesions are extensive and the lymph nodes show unmistakable evidence of metastasis. In Table II the 119 cases have been grouped into the three stages just described. In the first stage there are 86 primary cases in which there was no clinical evidence of metastases.

In this group 100 per cent were well for more than five years. In the second stage there are 22 cases, four of which developed malignant metastases in the glands of the neck, and died. Eighteen cases (or 77.8

which four died from malignant metastases that developed after the primary lesion healed, there remain 104 cases (or 96.3 per cent) well after five years.

While radiation treatment in cancer of

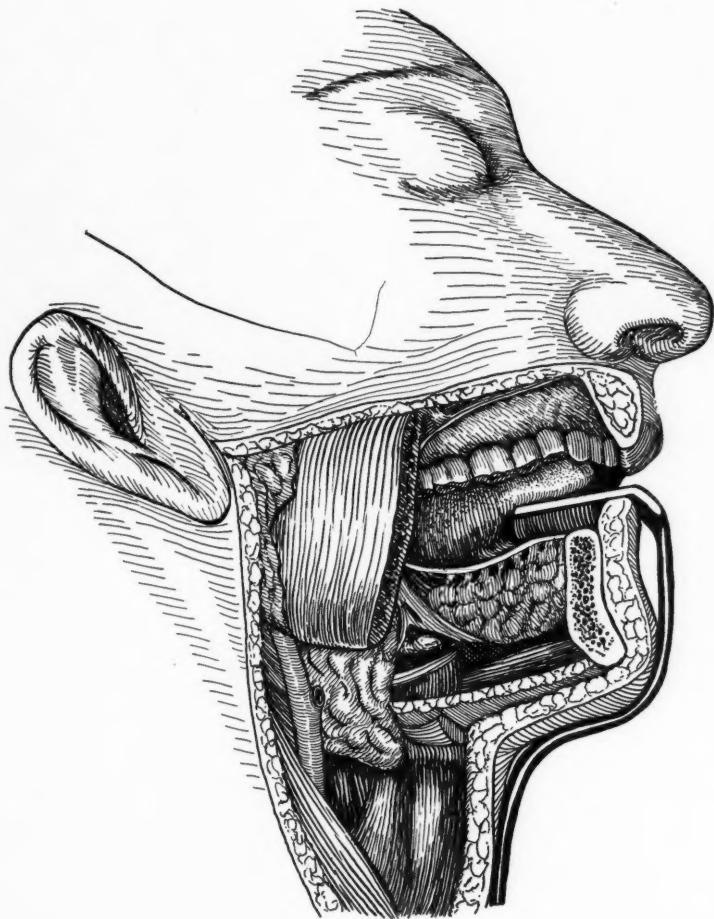


Fig. 7. In this case, the interstitial platinum radium needles inside the mouth were supplemented by 50 mg. of radium in capsules filtered through an equivalent of 3 mm. of lead for eight hours.

per cent) were well after five years. In the third stage there are 11 cases, all of which had lymph node involvement. All of the patients in this group died from cancer. If we eliminate the 11 cases in the last and incurable stage, leaving 108 cases in

the lower lip compares favorably with the results obtained by surgery, it has a great advantage in that cases treated by radiation have little or no scar or deformity at the site of the primary lesion, no scar over the cervical regions, and are not confined to the

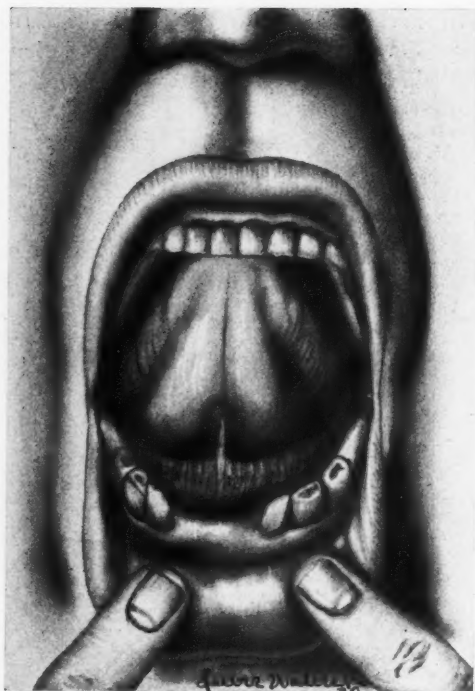


Fig. 8. Same case as seen in Figure 6, six months after treatment. There is no evidence of the former tumor.



Fig. 9. Infiltrating type of ulcerating carcinoma on side of tongue, treated by the implantation of twelve 0.6 mg. platinum radium needles around the edge of the ulcer for seven days. The glands in the neck were involved at the time of treatment.

hospital or home during the period of treatment. Furthermore, there is a reasonable assurance that there will be no recurrence of the growth in the area treated. In the third stage of cancer of the lower lip, a cure by radiation is not contemplated, but much can often be done in the way of palliation, by removing or improving the primary lesion, reducing induration, and inhibiting the progress of the disease for varying periods of time. The patient feels better, his appetite improves, weight increases, his confidence is restored, and life is prolonged for weeks, months, and sometimes years.

Three intensities—that is, superficial, intermediate, and deep—of roentgen therapy are used in treating cancer of the lip. The superficial dose is slightly less than two minimum erythema doses and is confined to an area not to exceed one and a half inches

in diameter. This amount of superficial radiation is repeated every other day for from four to six exposures, the number of treatments depending upon the nature, location, and size of the growth. The intermediate and deep doses produce a definite tan on the skin, with desquamation. These doses should be repeated with caution. The superficial dose is administered to the primary lesion while the intermediate and deep doses are reserved for the treatment of the neck where superficial and deep metastases occur. Used with judgment, the physician experienced in the administration of radiation therapy has at his command a valuable remedy for the cure of cancer of the lower lip and a temporary relief for many cases of advanced cancer that cannot be cured. Every case of cancer of the lower lip, even



Fig. 10. Same case shown in Figure 9. There is a deep fissure in the tongue but no induration is felt and the tongue is normal in size. The glands in the neck are still enlarged in spite of radium packs and deep X-ray therapy. Operation would have meant removal of the entire tongue, with a block dissection of the neck glands. The man is quite comfortable.

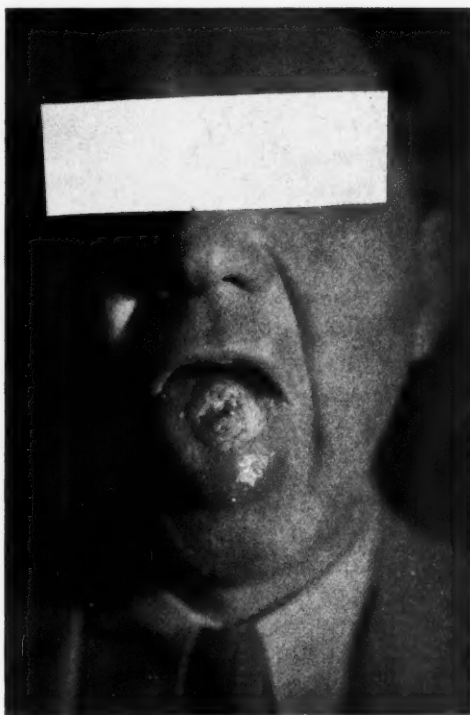


Fig. 11. Large squamous-cell carcinoma, Grade 3, near the center and well back on the dorsum of the tongue. There are no palpable neck glands at this time. Case referred by Dr. J. Bedford Shelmire.

though there are no palpable lymph nodes present, receives inhibitory radiation over the lymph chains on both sides of the neck. To neglect this is to invite metastases and an incurable condition.

In the beginning, radiation therapy, like surgery, was not very successful in the treatment of cancer inside the mouth. With greatly improved facilities, radiation therapy now promises to equal the results obtained in the treatment of cancer of the lower lip. It is our custom to use a modification of the Regaud (4) technic as described by Cade (5) rather than the radon implant method commonly used in this country. Fungating masses of cancer tissue, often a source of infection, are destroyed and removed bloodlessly by electrothermic coagulation. Sections are taken

from each case and submitted to a competent pathologist. Small platinum needles measuring 1 and 2.6 cm. in length and containing, respectively, 0.6 and 1.3 mg. of radium element buried in the tissues about the lesion for seven or eight days, have in our hands given excellent results. The needles have wall thicknesses of 0.5 and 0.6 mm., respectively. Experience has proven that the necrotic and painful effect of highly filtered radiation on normal tissue is far less severe than that produced by radium in steel needles. The platinum needles cause little discomfort although they are sewn in the tissues for seven or eight days. They will usually destroy a cubic centimeter of cancer tissue per centimeter length of the needle.

The method of introducing them into the



Fig. 12. Illustrating the method of implanting eight 0.6 mg. platinum radium needles, which were sewn in place in the tongue and left for seven days.

tumors in the mouth is very simple. Pledgets of cotton saturated with a 10 per cent solution of cocaine are held for ten minutes against the areas to be treated. The tissues are then thoroughly infiltrated with 1 per cent butyn, after which the needles are introduced painlessly and held in place with sutures placed in the normal mucosa. Care should be taken to place the needles one centimeter apart so as to completely surround and pass beneath the growth. If a radiograph is made after the needles have been introduced, their exact positions can be determined. The mouth must be kept as clean as possible at all times. Lately we have found aromatic chlorozene powder dissolved in warm water to be well tolerated as a mouth wash. The solution should be very weak at first and slowly increased to tolerance. Chartex diluted 1 to 3 is useful if the mouth is tender. The wash is used after each meal and the lesion is then painted with 2 per cent mercurochrome.

Capsules containing radium element filtered with an equivalent of three millimeters of lead in contact applicators of the type advocated by Grier (15) and Widmann (7) have been helpful and are often used to augment the needles in difficult locations. Malignant growths in the tongue, cheek, floor of mouth, alveolar margins, and anterior pillars respond to this technic. The tumors melt down in from one to three weeks and a superficial grayish membrane appears in the area treated. The membrane is in no sense a slough, and is accompanied by little or no pain. Soft and liquid foods are taken freely during and after the treatment. At the end of from three to six weeks the membrane begins to disappear rapidly and healing takes place. Usually the lesion is healed in from two to two and a half months. The 0.6 mg. needles may be used in close proximity to the bone without untoward effects.

Externally, highly filtered radium packs and deep X-rays supplement the needles and capsules used inside the mouth. The skin will tolerate a surprisingly large amount of combined radiation, as the workers at the Memorial Hospital have pointed out.

When large glands are present in the neck, large doses of implanted radium in the form of small steel needles (6.25 mg.) are added to the above procedure. It is our feeling that the value of block dissection is not definitely established in these cases and we have been slow to advise it.

We have not used this technic long enough to report statistics of any great value, but our results have been so favorable in a considerable number of cases that we believe we are curing many early intra-oral cancers and certainly are greatly benefiting those patients who cannot be cured, by prolonging their lives and making their last days more comfortable.

While radiation therapy promises much for the cancer victim and what I have said

is extremely optimistic, it should be remembered that the remedies are not without their dangers and that radiation therapy should not be entrusted to those who are un-

cancer of the lower lip are roughly classified under three stages.

3. In 119 cases of cancer of the lower lip treated by X-rays, 86 were in the first



Fig. 13. Radiograph made in a vertical position showing location of the platinum needles after they were placed in the tongue.

acquainted with its possibilities. Chronic painful radiation necrosis is the result of over-treatment, while under-treatment is of little or no value. Fortunately, the normal tissues will stand a considerable overdose of radiation without harm and the experienced and careful physician will try to stay within this limit.

CONCLUSIONS

1. It is our belief that cancer of the mouth and lower lip, in early stages, does not frequently metastasize.

2. For clinical convenience, all cases of

stage, 22 in the second, and 11 in the third stage.

4. In the first and second stages there were 108 cases that showed no evidence of metastases at the time of treatment. Later, four cases developed malignant nodes in the neck, and died. The remaining 104 cases (or 96.3 per cent of the cases in the first and second stages) were well after five years.

5. The eleven cases in the third stage had definite lymph node involvement at the time treatment was begun. All of the patients in this stage died from cancer.



Fig. 14. Appearance of the tongue at the end of the seventh day when the needles were removed.



Fig. 15. Appearance of the tongue six months after treatment. It is normal in size and shape and there is no evidence of the former growth. Same case shown in Figure 14.

6. It is our experience that early malignant lesions inside the mouth respond remarkably well to small amounts of radium in platinum needles implanted in the tissues. Interstitial radiation inside the mouth is augmented by highly filtered radium packs and X-rays externally.

7. Mouth hygiene is an important factor in the successful conduct of this class of cases.

8. Incurable cases of cancer of the mouth and lips can often be greatly benefited by radiation therapy, while in some cases life can be prolonged for months.

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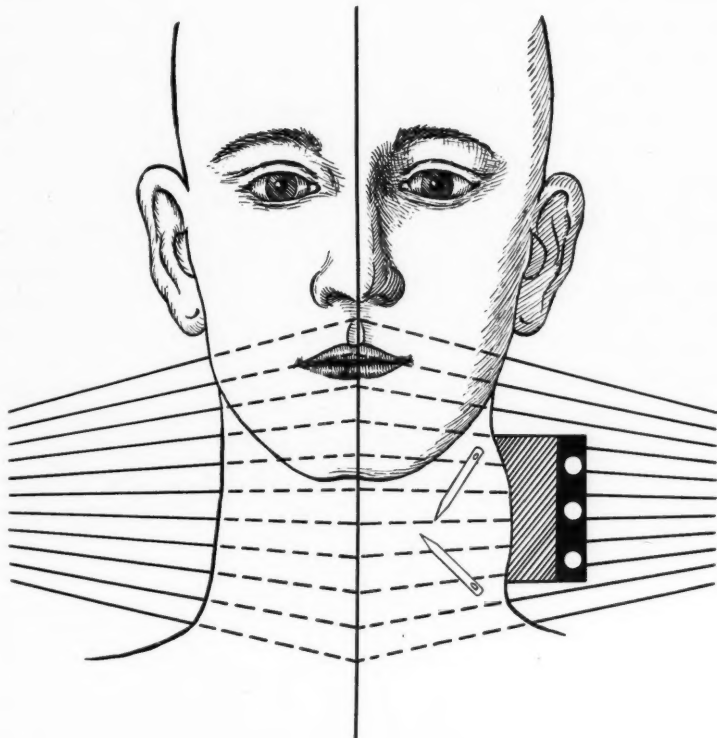


Fig. 16. When metastases appear in the glands in the neck, interstitial platinum radium needles and external radium packs with heavy lead filters are supplemented by short wave X-rays.

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DISCUSSION

DR. H. J. ULLMANN (Santa Barbara, California): When I visited Dr. Martin at Dallas, I was thoroughly sold on the large dosage technic. My technic to-day on these lip cases, as well as on other forms of skin malignancy, is 10 skin units, that is, 3,200

r, unfiltered. I divide this into three or more doses, one day between doses. It is very essential, however, to protect the gums, for the radiation will go straight through the lip and produce a severe reaction on its inner side as well as on the part directly receiving the radiation. As far as I can see, one cannot give too much radiation within reasonable limits on these comparatively small lesions. If one is going to treat a lesion ten or fifteen centimeters in diameter, one must be careful because of the slow healing or lack of healing due to a destruction of the blood vessels, but on the smaller lesions one can give a dose almost without limit. In any case it is better to over-dose than under-dose, because the cancer will be destroyed, and if the normal tissue does not heal, it can always be removed surgically.

I wish to compliment Dr. Martin on his work. Those who have visited him are saving many more lives than ever before.

DR. MARTIN (closing): I want to endorse what Dr. Ullmann has said, except that I think he ought to use a filter. In my early work without filtration, telangiectasis in the area treated was frequently observed. Of course, the technic of that period was not the same as the one used by Dr. Ullmann. Since adopting filters we have treated more than four thousand cases without a single troublesome case of telangiectasis. I cannot help but think that filtration obviates this complication, and, if it does, we should use it.

In treating lesions inside the mouth, hygiene is extremely important and must not be overlooked. I do not want to advertise a proprietary preparation but lately we have found chlorozene dissolved in water and diluted to tolerance to be useful in keeping the mouth clean. Borate of soda with menthol and thymol dissolved in dilute alcohol and filtered through carbonate of magnesia, makes an excellent cleansing mouth wash following the use of radium.

APPARATUS FOR THE MEASUREMENT OF HIGH CONSTANT OR RIPPLED VOLTAGES¹

By LAURISTON S. TAYLOR, Bureau of Standards, WASHINGTON, D. C.

Abstract.—An improved form of high resistance to be used as a high voltage voltmeter multiplier for use up to 150 K.V. is described. The total resistance is 100 megohms, designed to be coronaless by placing one hundred 1-megohm resistors in 20 corona cases containing 5 resistors each, the corona cases being mounted in series on top of each other. The

complete unit is readily portable. Methods of calibrating the resistance under full-load conditions are described. Errors are discussed and necessary corrections, to give a maximum error in high voltage measurement of 0.01 per cent, are given. A new type of high voltage string electrometer for use in connection with the resistance is also described.

I. INTRODUCTION

With the increasing use of high rippled or constant voltages for precise physical and commercial purposes, it is becoming more necessary to make accurate measurements of the magnitudes dealt with. Of these, the most difficult is the measurement of potential, yet in the field of pure and applied X-rays this is particularly important for various reasons.

Since the early work of Farnsworth and Fortescue,² Chubb,³ and Peek,⁴ A.C. voltages have been measured largely with the sphere spark gap for which an empirical calibration was established. This calibration being independent of the frequency over wide ranges has justified its use to measure either rippled or constant voltages. However, to attain the highest accuracy by such a means the

spheres must be so large (25 to 50 cm. diameter) that their use is almost eliminated in the ordinary laboratory. In addition, the constructional details must conform to certain arbitrary specifications, and corrections must be made for atmospheric conditions. With the 125 mm. spheres more commonly used, the errors increase until the precision necessary for many physical purposes is no longer obtainable.

Another important disadvantage of the sphere gap method is that its use necessarily interrupts the high voltage which it is to measure. This is particularly troublesome in the case of the usual ripple voltage obtained from kenotron-condenser rectifier circuits.

Various types of electrostatic voltmeters have been devised for measuring these high voltages. They have been calibrated in most cases either with a 125 mm. sphere gap or by means of the short wave length limit of the X-ray continuous spectrum, using the relation $V = 1.234/\lambda_0$ where V is the maximum voltage expressed in kilovolts and λ_0 is the spectrum limit expressed in Ångströms. The sphere gap method of calibration is limited by the inaccuracies of the sphere gap used; the second is possible only in a well-equipped X-ray laboratory having an accurate ionization X-ray spectrometer. A high precision absolute electrometer for A.C. potentials up to 250 K.V. has been built

¹Up to the present the term "constant potential" has been used indiscriminately in describing the potential supplied by kenotron or other valve tube rectification. Accordingly we will in the future use a new, more accurate designation of voltages which are actually not constant but fluctuate about a certain average value. We thus define a "ripple quantity" (potential or current) as a simple periodic quantity $y = V_0 + V_1 \sin(\omega x + \alpha_1) + V_2 \sin(2\omega x + \alpha_2) + \dots$ in which the constant term V_0 is so large that all values of the quantity are positive (or negative). The amount of ripple ("ripple" or "ripple") in a ripple quantity is the ratio of the difference between the maximum and minimum values of the quantity to the average value.

The above definitions are being considered by the Committee on Electrical Definitions of the American Standards Association under the sponsorship of the A. I. E. E.

²S. W. Farnsworth and C. Fortescue, Trans. A. I. E. E., 1913, XXXII, pt. 1, p. 733.

³L. W. Chubb and C. Fortescue, Trans. A. I. E. E., 1913, XXXII, pt. 1, p. 739.

⁴F. W. Peek, G. E. Rev., 1913, XVI, 286; and Trans. A. I. E. E., 1913, XXXII, pt. 1, p. 812.

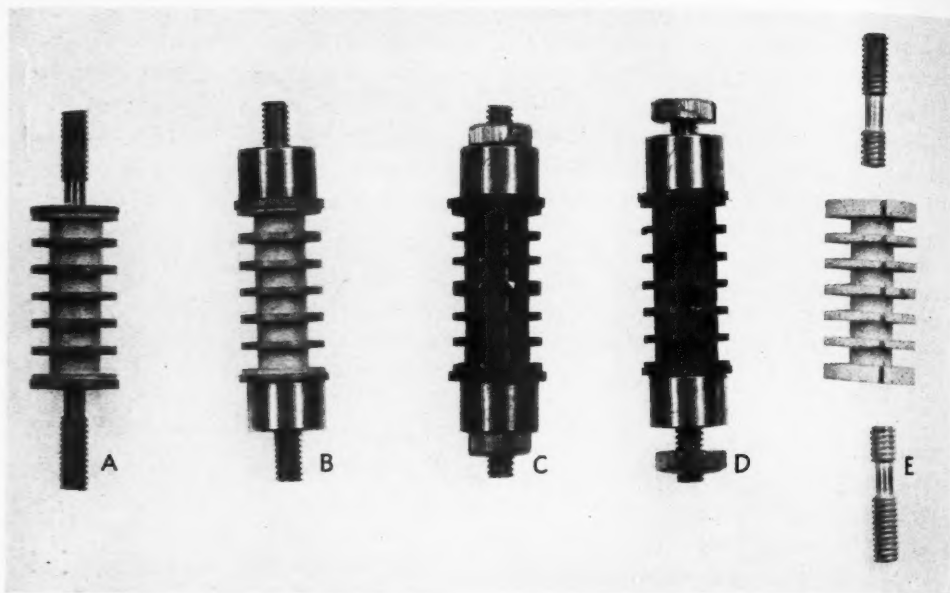


Fig. 1. Wire resistors used in multiplier. *A, B*, lavite bobbins; *C, D*, complete resistor wound in six spools; *E*, isolantite bobbin.

by Brooks,^{5, 6} but unfortunately is not applicable to D.C. voltage measurements.

Thus far, the only accurate method of measuring high D.C. potentials has been by means of a high resistance used as a voltmeter multiplier. This method has been employed by Webster, Duane, and Terrill; and, while serving well the particular purpose, the resistances have been unwieldy and have drawn considerable power from the high voltage source.⁷

As a part of the Bureau's program of practical X-ray studies^{8, 9} it was considered necessary to make a careful study of high voltages under actual operating conditions. This has necessitated the construction and

calibration of accurate electrostatic voltmeters and of small sphere gaps. For this there has been developed a compact and portable voltmeter multiplier which consumes but 1 milliamperes per 100 K.V. and hence can be maintained in continuous connection with the usual high tension system without interfering with its operation.

II. CONSTRUCTION AND TEST OF MULTIPLIER RESISTORS

1. Construction of Individual Units

It was desired to make the unit of standard materials, if possible; hence, a number of different types of commercial resistors were tried. Those finally selected were 1-megohm units of nickel chromium wire with a special insulation designed to withstand both high temperatures and high voltage. Nickel chromium was chosen in spite of its comparatively large temperature coefficient because manganin or constantan

⁵See L. S. Taylor and G. Singer, Bureau of Standards Jour. Research (R.P. 211), 1930, V, 507.

⁶See C. Snow, Bureau of Standards Jour. Research (R.P. 17), 1928, I, 513.

⁷H. M. Terrill, C. T. Ulrey, X-ray Technology, pp. 112-116, Van Nostrand, 1930.

⁸L. S. Taylor, Bureau of Standards Jour. Research (R.P. 56), 1929, II, 771.

⁹L. S. Taylor, Bureau of Standards Jour. Research (R.P. 119), 1929, III, 807.

would have made the units too bulky. In these resistors the wire is wound on six-spool bobbins, 1 megohm to each, as shown in Figure 1.

Two kinds of bobbin material, both of

energy dissipation of 1 watt. With each unit subjected in air to an applied potential of 1,000 volts, d.c., for 8 hours no indication of breakdown appeared. With 1,415 volts, d.c. (2 watts), for 2 hours, the result

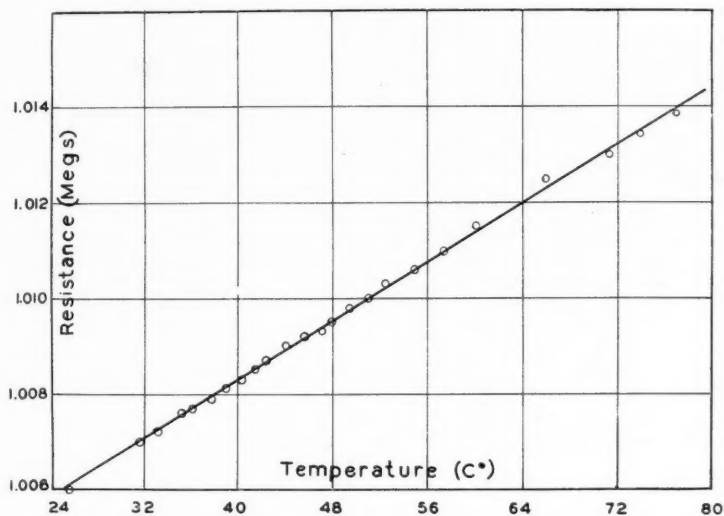


Fig. 2. Curve for obtaining temperature coefficient of a single resistor.

which proved satisfactory, were used: (a) Lavite, carefully baked after machining and then impregnated with paraffin; and (b) isolantite, which is supposedly less likely to absorb moisture. The spools are wound successively and the bobbins practically non-inductively by reversing the direction of winding in adjacent spools, the wire passing from one spool to the next through the slot in the partition,¹⁰ and its ends soldered to brass studs cemented into the ends of the insulating base. Radiographs were made of several to inspect the effectiveness of the cement and to reveal possible leakage paths through the insulation.

2. Test of Individual Units

The manufacturer's rating for each unit was given as 1 megohm ± 1 per cent with an

indicated that a 100 per cent overload was safe; 2,000 volts (4 watts) for 2 hours caused breakdown in only 3 per cent of the units tried. These tests, repeated with the units immersed in ordinary high tension transformer oil, showed no breakdowns.

A special high voltage Wheatstone bridge was constructed so that the resistance of the bobbins could be measured under load conditions. In the two arms of the bridge on one side of the galvanometer were placed, respectively, the unknown resistor of about 1 megohm and a dial manganin resistance box, ranging from 0 to 1,111,111 ohms in 1-ohm steps. In the other two arms were placed manganin resistances of 5,000 ohms each; voltages up to 2,000 volts, d.c., were applied directly to the bridge. With this operated at 1,000 volts it was possible to detect a change in resistance of the bobbins of 1 part in 100,000, although the absolute ac-

¹⁰Measurements made elsewhere have shown the inductance to be slightly negative but negligible for the purpose at hand.

curacy was limited to 0.01 per cent by the uncertainty in the calibration of the bridge arms.

With this bridge it was readily possible to examine any unit under operating conditions and detect any failure of the resistor,

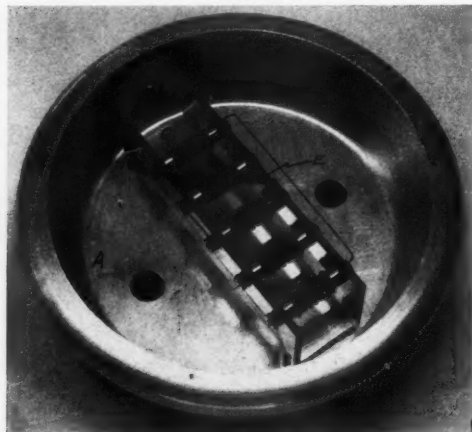


Fig. 3. An assembled unit of five resistors in spun aluminum corona shield with cover removed.

such as a breakdown between windings at high voltage. To determine the temperature coefficient of resistance, the resistor was immersed in a large beaker of transformer oil heated to 80°C ., and resistance measurements made with the bridge every few minutes as the oil (well stirred) cooled down to room temperature. The results, plotted in Figure 2, gave a temperature coefficient of 0.0152 per cent per $^{\circ}\text{C}$.

All resistance measurements at other room temperatures were corrected by this coefficient to 20° as standard.

For determining the resistance of each bobbin, two methods were used: (a) With low voltage (25 volts) applied to the bridge continuously, and (b) with high voltage (1,500 volts) applied for about one second, followed by a long interval of rest during which the bridge was adjusted in preparation for the next trial for balance. In neither case was appreciable heating of the coil produced. Results by the two methods

agreed to better than 0.1 per cent, and thus justified the use of method (a) for routine measurements of room temperature resistance. Surface or body leakage of the lavite and isolantite was tested by connecting an unwound bobbin in series with a galvanometer of sensitivity 10^{-8} amps. per millimeter and a source of potential of about 1,300 volts, D.C. No measurable current passed through, indicating the resistance to be greater than 10^{11} ohms and negligible as a source of leakage. A leakage test with the hard rubber supports, similar to that for the bobbins, proved this insulation to be satisfactory also.

III. CONSTRUCTION OF THE COMPLETE UNIT

For the purpose at hand a resistance suitable for the measurement of 150 K.V. was needed. As a result of the above tests, 100 megohms were shown to carry 150 K.V. safely, thereby giving a working current of 1.5 milliamperes and dissipating a maximum of but 225 watts. Connecting 100 resistors in series in open air would have resulted in excessive corona around those at the higher potentials and would thus have introduced three serious difficulties: (a) Corona bombardment which would eventually break down the insulation of the wire, (b) the precipitation of dust from the air which would eventually cause serious surface leakage, and (c) the possibility of a corona current of sufficient magnitude to introduce error. This might be avoided by immersing 20 bobbins in series in a $1\frac{1}{2}$ -inch pyrex tube filled with high tension transformer oil. By so doing the maximum potential difference between the ends of the tube would be only 30 K.V., thus eliminating excessive circulation of the oil. Five such units in series, properly suspended in air and kept free from dirt, would provide a fairly suitable multiplier for 150 K.V. This method is open,

however, to two main objections: (a) It is difficult to get at the individual resistors to measure their resistance, and (b) the oil may eventually break down sufficiently to cause appreciable leakage.

To eliminate the difficulties above, the

For convenience, 2 stacks of 10 shields each were supported (Fig. 5), top and bottom, on electrose insulators mounted in a dried oak frame which had been painted with several coats of shellac. These frames can be used separately as in Figure 5 or

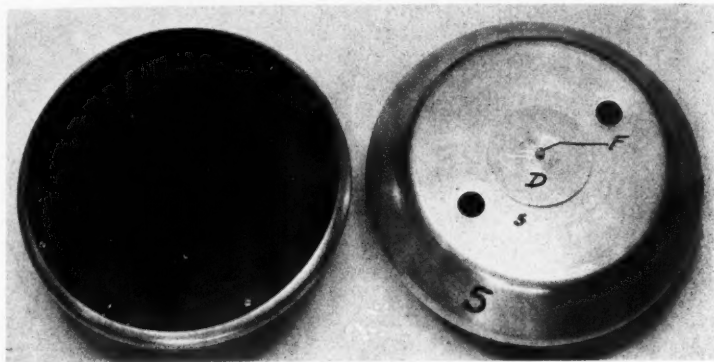


Fig. 4. Complete unit with cover attached.

100 units were finally assembled into 20 sets of 5, each 5 being mounted in a spun aluminum corona shield, *A* (Fig. 3), on a frame of polished hard rubber, *B*, carried by an aluminum base plate, *C*, which is bolted to the shield with a 3-inch disk of one-eighth-inch aluminum, *D*, serving as a nut. The resistors are connected in series in such a way that only 40 per cent of the potential applied to a shield exists between each bobbin and its nearest neighbor and thus effects a minimum potential difference along the hard rubber support.

One end of this group resistance is permanently fastened to the shield, and the other end to a flat phosphor bronze spring, *E*, mounted on the hard rubber frame. Covering the open face of the corona shield is a one-fourth-inch hard rubber disk (Fig. 4). In both shield and cover are two 1-inch holes to provide ventilation. A stud, *F*, protruding from the aluminum disk, *D*, is screwed into the hard rubber cover of the next corona case so as to make electrical contact with the spring *E*.

placed one on top of the other and connected in series as in Figure 6.

The assembled multiplier has the following advantages: (a) The maximum potential difference between any resistor and its surroundings is only 7.5 K.V.; hence, there will be no corona inside the shield and a minimum of dust precipitation; (b) all corona shields are maintained at a fixed potential difference of 7.5 K.V., maximum, with respect to adjacent shields, so the total stack is coronaless; (c) the electrostatic shielding effect of the corona case protects the hard rubber cover of the next above from corona bombardment; (d) the small gap between corona cases minimizes the possibility of sunlight affecting the insulating qualities of the hard rubber; (e) dull black lacquer on the inside and outside of the corona cases permits a maximum of heat radiation;¹¹ (f) the separation into 5 megohm units permits

¹¹The size of the corona case is such that ten resistors might have been placed in each instead of five. However, this is undesirable, since it would double the amount of heat to be dissipated per unit and cause additional heating of the coils.

easy tests for possibly defective resistors, and likewise a ready calibration of the resistance of each.

small. The stack is, however, rendered more fragile when using glass. For measurements of short duration, hard rubber has

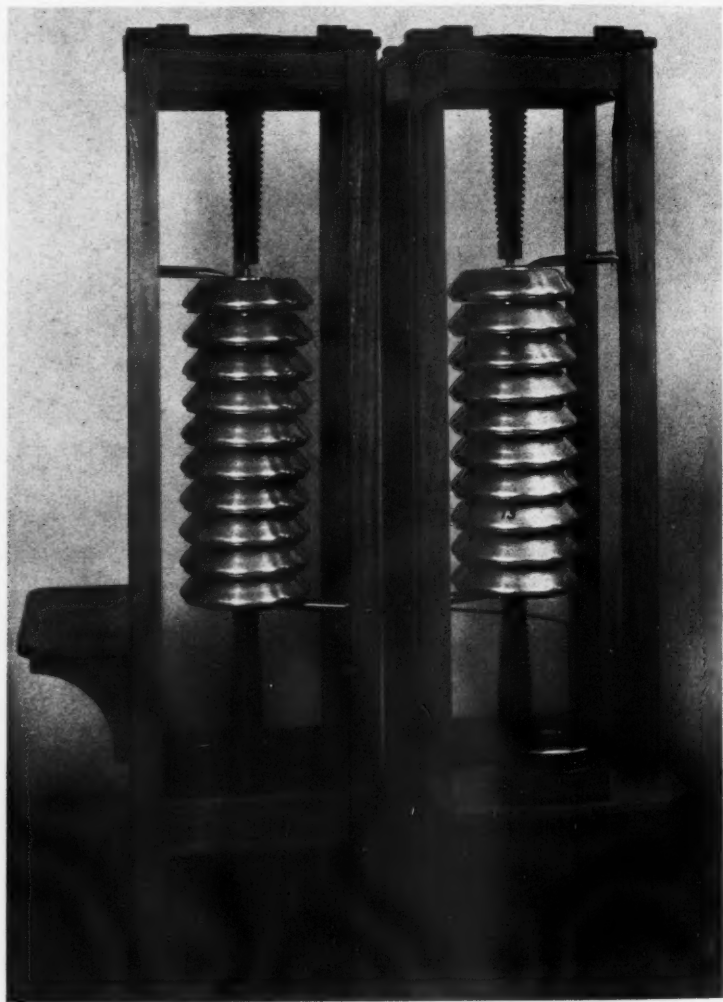


Fig. 5. Assembled resistor of 50 megohms per stack. In the particular case shown a microammeter is in a grounded circuit dividing the stacks.

It might be pointed out that, for continuous use, the hard rubber deforms appreciably. This has been avoided by making the covers of one-fourth-inch micanite or pyrex glass plates, pyrex being used in preference to other glass because its surface leakage is

proved to be satisfactory, and, moreover, furnishes a readily portable apparatus.

IV. PERFORMANCE TESTS

It was found that the assembled stacks, when subjected for several hours to high

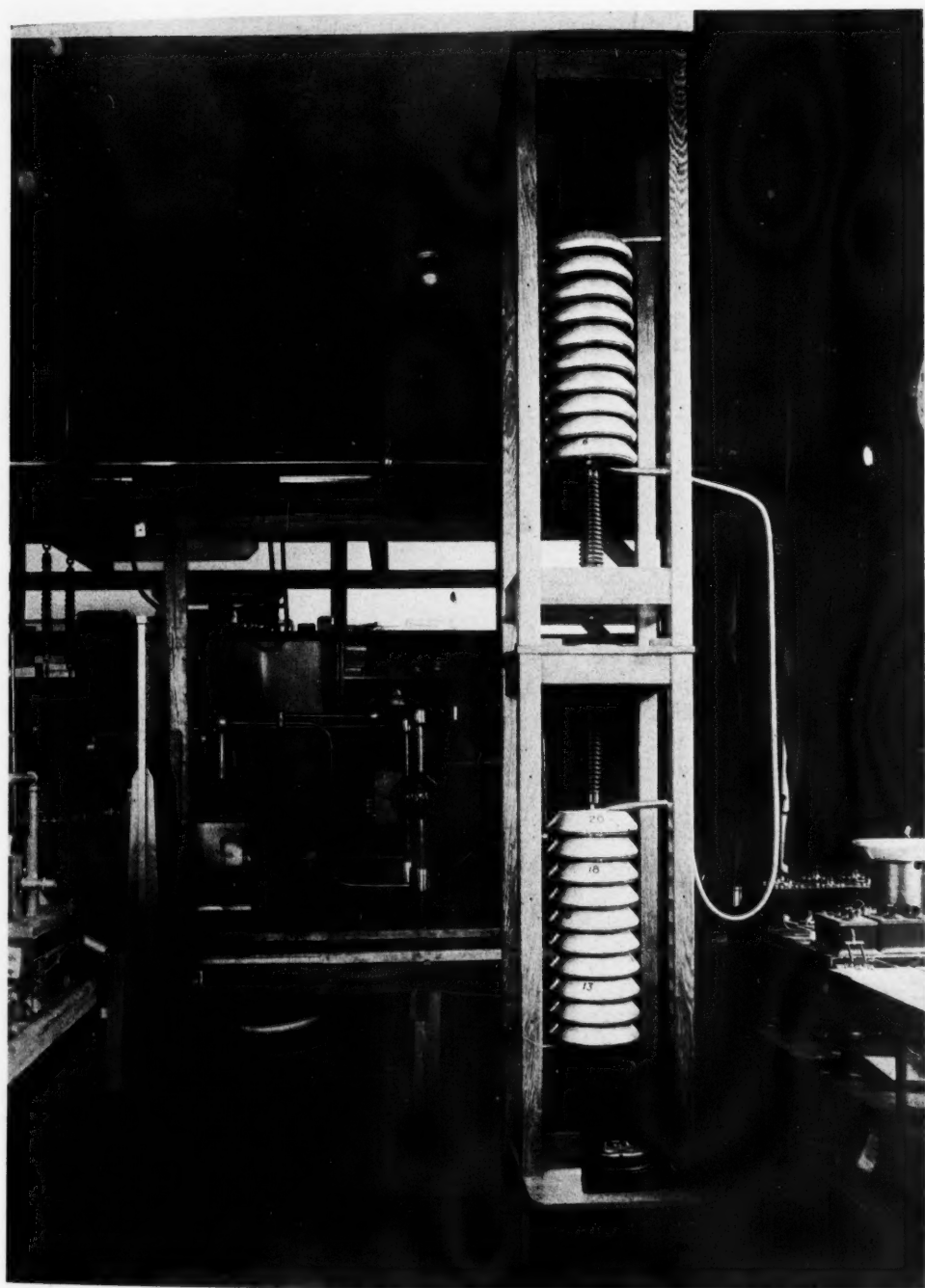


Fig. 6. Two 50-megohm stacks, connected in series and mounted one above the other. At the right can be seen the high voltage bridge and in the background a part of the high voltage generator.

D.C. potentials up to 75 K.V. (per stack), carried the load without damage. The resistance of each case was measured before

sembled stack, one resistor in the center was detached from the main circuit and leads taken out to the Wheatstone bridge by

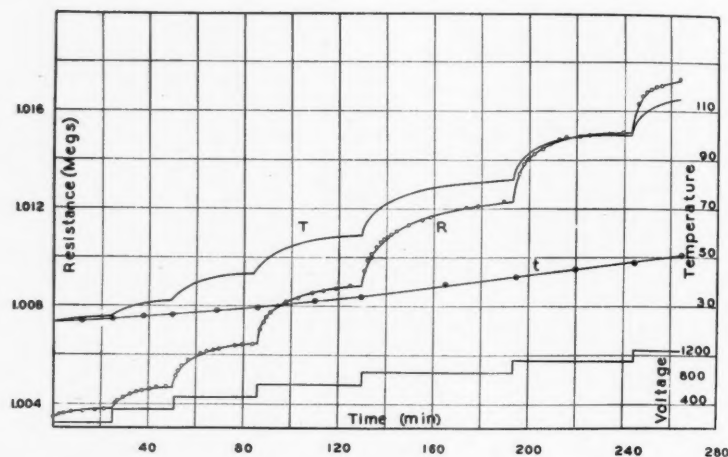


Fig. 7. Resistance curves to show effect of heating of the resistors under operating conditions. Voltage increased by steps.

and after application of the voltage, as described above, with approximately one-fifth of the maximum working voltage applied across the case. The few bobbins which showed any change in resistance were then discarded.

It was impossible in actual operation to make any measurement of the temperature attained after temperature equilibrium had been reached, since this is affected by the proximity of other heated coils and the restricted air space of the corona case. However, a temperature correction for single resistors may be determined as a function of the current passing through the coil. This is obtained by applying a given potential to the single resistor and measuring the resistance after equilibrium has been reached. A curve may then be plotted giving directly the change in resistance as a function of either the voltage drop or the current in the coil. A number of resistors were so tested in open air and the characteristics of all were found to be exactly the same.

To determine the correction for an as-

sembled stack, one resistor in the center was detached from the main circuit and leads taken out to the Wheatstone bridge by which the resistance was measured at room temperature and corrected to 20° C. Next the resistance was measured for a series of potentials up to the maximum while in each case a potential from an independent source of 49 times the bridge potential was applied to the remaining 49 units in series. By this means the resistance of a single unit under actual operating conditions of voltage and heat radiation was obtained, the measurements being made at a given potential every two or three minutes until equilibrium was reached.

The results of this are plotted in Figure 7 for potentials up to 1,300 volts per resistor. Examination of the curves shows that equilibrium, within about 0.02 to 0.03 per cent, is reached in about 20 minutes. Having the no-voltage resistance at 20° C., the percentage correction for each voltage (or corresponding current) was calculated from these curves.

Curve *a* (Fig. 8) shows the correction to be applied to the resistance when the reading is taken 20 minutes after the potential

is applied. Thus, when using the stack for voltage measurements, this curve gives for every current the necessary correction for

voltages were brought up to the desired value instantly instead of in steps.

It should be mentioned that a correction

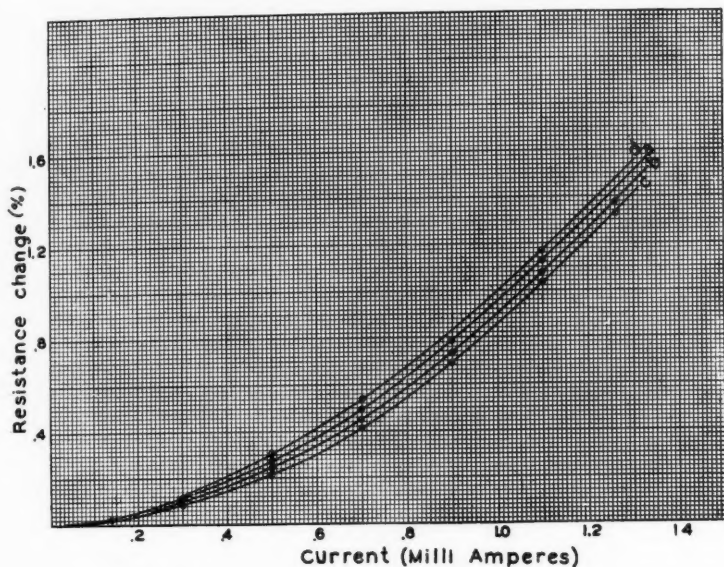


Fig. 8. Curves showing the percentage correction to be added to the total resistance to correct for heating. Voltage increased by steps.

the resistance to within 0.02 per cent. Curve *d* shows a similar result for 40 minute readings. Curves *b* and *c* give corrections for readings taken, respectively, 10 and 5 minutes after application of voltage. The fact that *b* and *c* are smooth curves indicates that such readings are just as reliable as those taken nearer equilibrium. The difference between any two of these correction curves is only about 0.04 per cent, so that great care does not need to be taken in timing the duration of the current. When neglecting corrections, the error is only of the order of 1 per cent.

Curve *T* in Figure 7 shows temperature of the coils as calculated from their temperature coefficient, while Curve *t* gives the air temperature within the corona case, indicated by a mercury thermometer inserted through one of the holes.

The same correction was found when

must be made, of course, for any room temperature differing from that at which the resistance was calibrated under no-load conditions. In the present case the no-load resistance must be increased by 0.015 per cent for each degree rise in temperature of the room above 20° C.

V. APPLICATION TO HIGH D.C. VOLTAGE MEASUREMENTS

The application of such a resistance to high voltage D.C. measurements is well known and straightforward, and consequently need not be dealt with in detail.¹² Two methods are common: (*a*) To measure the potential drop v across a small known resistance r in series with the high resistance R , calibrating the galvanometer with a standard cell for each reading, and (*b*) to make a direct measurement, by means of a

suitable galvanometer or microammeter, of the current i flowing through the resistance. By method (a) the high voltage V_0 is given

volts to within ± 0.1 per cent (Figs. 9 and 10). A drawn platinum wire, A , of 0.01 mm. diameter (shown in a heavy line) is

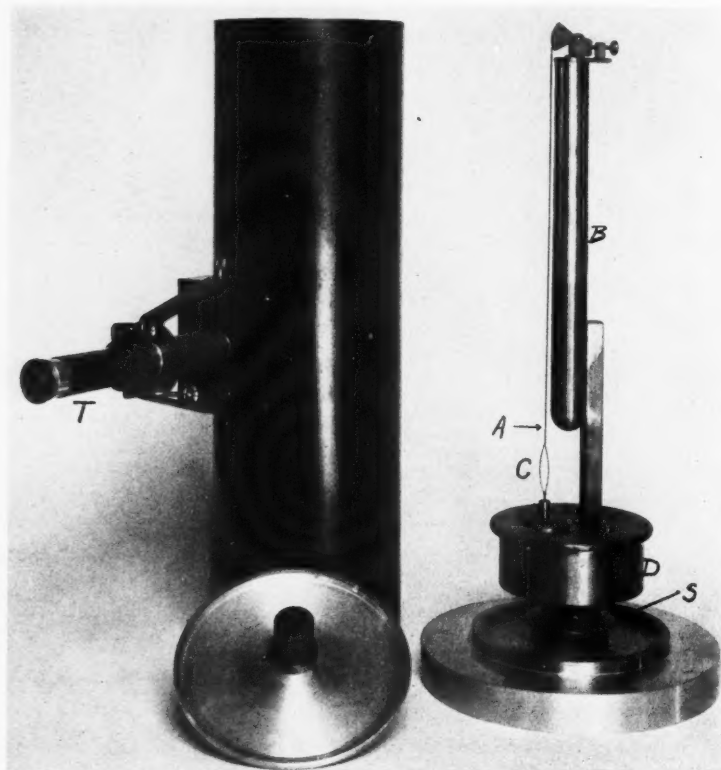


Fig. 9. Details of electrometer. Fiber and quartz loop have been drawn in so as to be visible.

by $V_0 = v(R + r)/r$ where R is the total resistance. By method (b) the voltage is given by Ohm's law, $V_0 = iR$.

For some purposes, for example, our X-ray studies, it may be desired to make not only an accurate measurement of the high potentials, but to determine also the magnitude of any small irregular fluctuations in the ripple voltage. To do this a new type of high voltage electrometer was developed, suitable for measuring voltages up to 1,000

suspended about 2 mm. from a 2.5 cm. brass tube, B . This wire is under the tension of a loop of coarse quartz filament C at the lower end and its adjustable suspension above. This system is surrounded by a cylindrical copper case about 5 inches in diameter, supported at the base by a good insulator. With the case grounded and a potential applied to the inner insulated system, consisting of tube and wire, we have an idiostatic electrometer the sensitivity of which may be altered at will by changing the tension on the wire. The period of the wire is

²²See Footnote 7, page 894.

so short that it follows rapid fluctuations in voltage.

The displacement of the fiber is observed by means of the telescope, *T*, provided with an ocular scale of 100 divisions. By suitably adjusting the fiber tension the electrometer will deflect 100 divisions per 1,000 volts, and readings can be readily made to within one-tenth division, which is equivalent to about 0.2 volt at the extreme end of the scale. Calibration of the electrometer is effected by means of a 1,500-volt d.c. generator. As an alternative, the zero may be set off scale and the fiber tension adjusted to bring the desired voltage range on the scale.

Figure 10 shows three calibration curves for the electrometer when the tension, *t*, of the fiber is changed ($t_A > t_B > t_C$). Thus, in measuring a potential of the order of 1,000 volts, the conditions represented by Curve *C* are most suitable. In using this instrument, as suggested above, it is shunted around the last 1 megohm resistor (at the grounded end of the stack) and the electrometer case grounded. Knowing the value of the shunted resistor, the voltage drop across it gives directly one one-hundredth of the total voltage across the stack. Any fluctuations of very short duration may then be measured by the play of the electrometer fiber.

This suggested a further application of the fiber electrometer. When the resistors are heated by the current flow, the resistances of all vary in the same proportion. Consequently if the resistance of a single unit is accurately known and also that of the total stack, the potential drop across this unit is in direct proportion to the total resistance under all temperature conditions. Thus, by measuring electrostatically the potential drop across this unit, the total potential drop across the whole resistance is obtained without recourse to any of the corrections discussed in Section IV. Readings taken in this manner are independent of the time of observation and the accuracy is that

of the electrometer, in this case about ± 0.1 per cent.

For convenience in observation, and to

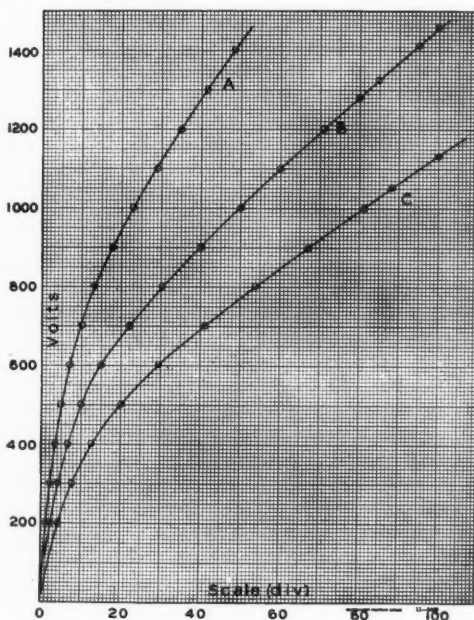


Fig. 10. Calibration curves for high voltage idiosyncratic electrometer. Fiber tension for Curve *B* less than for Curve *A*, etc.

increase the scale, a projecting system has been used with the electrometer in which a 1,000-volt deflection covers a 500-division scale.

In case such an electrometer is to be used for measuring high static potentials, the supporting insulator, *S*, must be such that no appreciable surface leakage takes place across it.¹³ The surface of the insulator always becomes slightly charged due to creepage. To prevent such a charge from affecting the electrostatic field within the electrometer, the insulator is covered with a metallic apron, *D*, to serve as a shield.

It might be mentioned that a similar type of electrometer has been constructed for direct measurements up to 100 K.V. When

¹³Bakelite is unsuitable for such insulation.

calibrated by means of the high resistance stack, described above, it can be used directly on a high voltage system without consuming any energy. In this case corona about the small fiber is avoided by special corona shields over the ends of the support. With

this instrument it is possible to detect and measure the ripple of a ripple potential X-ray generator.

Credit is due C. F. Stoneburner, of the X-ray laboratory, who carried out all of the resistance measurements discussed above.

The Effect of Barium Sulphate upon the Incidence of Human Intestinal Protozoa. Justin Andrews and Moses Paulson. *Jour. Lab. and Clin. Med.*, October, 1930, XVI, 39.

Stool examinations were done on a large number of patients suffering with parasitic infections of the bowel following ingestion of barium sulphate. There was such a reduction of the number of intestinal protozoa per volume unit of stool that it was frequently impossible to detect them microscopically. The intestinal amebæ were more conspicuously affected than the intestinal flagellates. The decrease was transient and even extending the period of administration of the barium sulphate did not prolong the effect.

A. O. HAMPTON, M.D.

Stem Radiation, Air Absorption, and Inverse Square Law. Hermann Hase and Hans Küstner. *Strahlentherapie*, 1930, XXXVIII, 543.

The authors studied the influence of the stem radiation and of the absorption of roentgen rays in the air on the validity of the in-

verse square law. One tube with block anticathode and one tube with plate anticathode were used at 100 K.V., 2.0 mm. Al; 140 K.V., 0.5 mm. Cu, and 180 K.V., 1.0 mm. Cu. Two electrometers recorded the output. It appeared that the intensity of the stem radiation runs parallel to the thickness of the stem of the anticathode. Its intensity is also dependent upon the running time of the tube regardless of the tube current. After the tube has been worked up properly, the stem radiation from a certain point of the stem can be reproduced at different tube currents. The closer the point of origin of the stem radiation is to the focus, the more does its intensity decrease with increasing tube current. This is more pronounced at low potentials. If one disregards the stem radiation and the loss due to air absorption, the deviation from the inverse square law may be considerable. If one corrects for the air absorption and includes the stem radiation, the inverse square law holds. The experimental data agree with the theoretically predicted results.

ERNST A. POHLE, M.D., Ph.D.

FIFTH LUMBAR VERTEBRA ROENTGENOLOGICALLY DEMONSTRATED¹

By WEBSTER W. BELDEN, M.D., Director of Department of Roentgenology,
New York Hospital, New York City

THE frequency of the requests for aid in determining the cause of low back pain by employment of the roentgen ray, stimulated us to undertake an investigation of the fifth lumbar vertebra from the roentgenological standpoint.

The first step is an anatomical study of

fifth lumbar vertebra is characterized by its body being much deeper in front than behind, which accords with the prominence of the sacro-vertebral articulation; by the smaller size of its spinous process; by the wide interval between the inferior articular processes, and by the thickness of its trans-

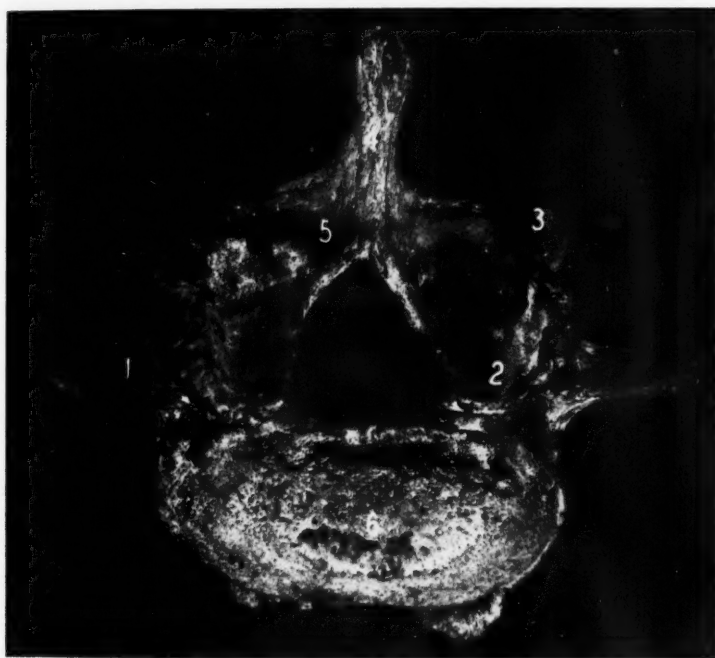


Fig. 1. Illustrating: (1) Transverse process; (2) superior articular facet; (3) inferior articular facet; (4) spinous process; (5) lamina of spinous process; (6) body.

the fifth lumbar vertebra, but, upon turning to the anatomy text-books, one is struck by the meager descriptions contained therein, an example of which is as follows: "The

verse processes, which spring from the body as well as from the pedicles."

In anomalies, however, one gets a clue. They are described as follows: "The last lumbar vertebra is subject to certain defects described as bifid and separate neural arches, and the latter occurring three times as frequently as the former. Both defects

¹Read before the Radiological Society of North America at the Fifteenth Annual Meeting, at Toronto, Canada, Dec. 2-6, 1929. Dr. Belden passed away before he had read proof on this paper, so that any changes he would have made in it are unknown.

result in weakness of the column—weakness of the bifid arch, by impairing ligamentous attachments, and of the separate arch through loss of bony anchorage of the column to its base.”

As the description of the other lumbar

short, and strong. The vertebral foramen is triangular, larger than in the thoracic, but smaller than in the cervical region. The spinous process is thick, broad, and somewhat quadrilateral; it projects backward and ends in a rough, uneven border, thickest be-

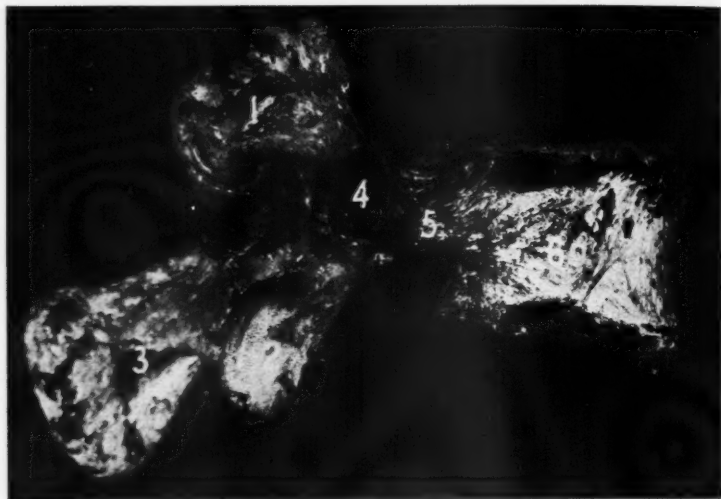


Fig. 2. Illustrating: (1) Superior articular process; (2) inferior articular process; (3) spinous process; (4) transverse process; (5) pedicle; (6) body.

vertebræ is more full and as it applies to the fifth lumbar vertebra, with exceptions as described above under the fifth lumbar, we feel that this description should be quoted: "The lumbar vertebrae are the largest segments of the movable part of the vertebral column and can be distinguished by the absence of a foramen in the transverse process, and by the absence of facets on the sides of the body. The body is large, wider from side to side than from before backward, and a little thicker in front than behind. It is flattened or slightly concave above and below, concave behind and deeply constricted in front and at the sides. The pedicles are very strong, directed backward from the upper part of the body; consequently the inferior vertebral notches are of considerable depth. The laminae are broad,

low, where it is occasionally notched. The superior and inferior articular processes are well defined, projecting upward and downward, respectively, from the junctions of pedicles and laminae. The facets on the superior processes are concave, and look backward and medialward; those on the inferior are convex, and are directed forward and lateralward. The former are wider apart than the latter, since in the articulated column the inferior articular processes are embraced by the superior processes of the subjacent vertebra. The transverse processes are long, slender, and horizontal in the upper three lumbar vertebrae, and incline a little upward in the lower two. In the upper three vertebrae they arise from the junctions of the pedicles and laminae, but in the lower two they are set farther forward and spring

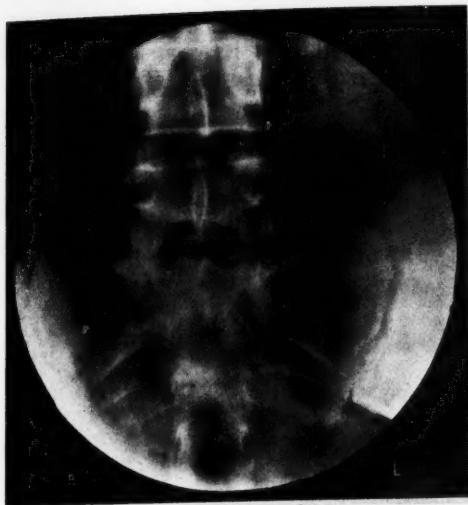


Fig. 3. Anatomical normal fifth lumbar vertebra, showing typical articular facets and normal transverse processes and normal articulations with the facets of the sacrum. This is in the female pelvis.

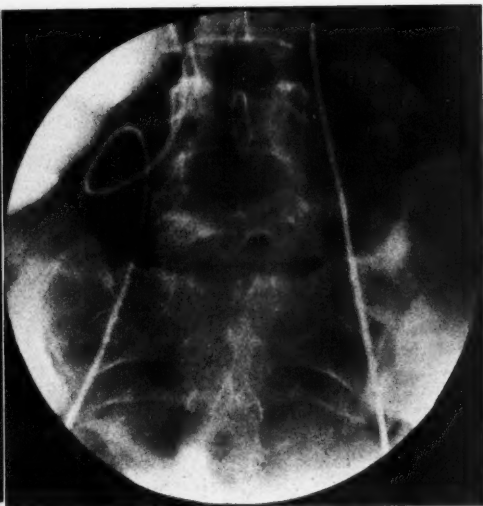


Fig. 4. Illustrating unilateral sacralization of the transverse process of the fifth lumbar vertebra. This sacralization is on the left side and the right transverse process is the usual type for the fifth lumbar vertebra. There is also a pseudo-sacral foramen between the fifth lumbar and the sacrum. This was encountered during an examination of the urinary tract.

from the pedicles and posterior parts of the bodies. They are situated in front of the articular processes instead of behind them as in the thoracic vertebrae, and are homologous with the ribs. Of the three tubercles noticed in connection with the transverse processes of the lower thoracic vertebrae, the superior one is connected in the lumbar region with the back part of the superior articular process, and is named the 'mammillary process'; the inferior is situated at the back part of the base of the transverse process, and is called the 'accessory process.'"

Our examinations of the fifth lumbar vertebra in consultation with surgeons and orthopedic men have led us to believe that there is a normal fifth lumbar vertebra, in accordance with the statement in George and Leonard's book, "The Vertebrae," in which they cite the work done in the Army, when about a hundred and fifty soldiers of average height, weight, and nourishment

were examined with a standard roentgen technic. The films were examined and all which demonstrated anatomical variations or were technically incorrect were thrown out. Of all the remainder, about seventy-five cases, tracings were made to determine an average normal from which one master-tracing might be made. A skeleton was then built up to correspond in every detail to the master-tracing. Roentgenograms were made and showed a normal standard fifth lumbar vertebra in its relations to the sacrum and the ilia. The parts of this vertebra, such as the laminae, the superior and anterior borders of the body, and the posterior surfaces, were covered with lead foil. The transverse processes were built up with lead on one side to represent the average minimum transverse process. This key plate is valuable in the study of the vertebrae, but Dr. George makes no great claim for the accuracy of this master key plate. However, an important feature of it is the fact that it



Fig. 5. Illustrating bilateral sacralization of the fifth lumbar vertebra, with bilateral pseudo-sacral foramen. This was encountered during a urological examination.



Fig. 6. This case illustrates a bilateral sacralization of the fifth lumbar vertebra, but a unilateral pseudo-sacral foramen on the right side; none on the left. This abnormality also was discovered during an examination of the urinary tract.

allows of a systematic method of study, being a criterion for determining minor abnormalities, congenital or otherwise, which might be overlooked.

George and Leonard state that the experiences of careful observers, especially the roentgenologists, seem to prove that there is an average normal fifth lumbar vertebra. This vertebra varies in size and shape but rarely in details of actual structure. In any observation of a large series of cases encountered in the examination of the spine itself, or incidental to the examination of the urinary or gastro-intestinal tract, one is forced to conclude that there must be a normal fifth lumbar vertebra. It is of the utmost importance for us to establish the fact that there is a standard for the normal fifth lumbar vertebra, because of the many congenital variations of this vertebra.

These variations are quite numerous and for the sake of convenience we wish to enumerate them.

CONGENITAL ANOMALIES

1. Sacralization of the transverse process:

- (a) unilateral
- (b) bilateral
- (c) with foramen {
 - unilateral
 - bilateral

2. Transverse processes narrowed and pointing upward:

3. Non-fusion of the laminae of spinous processes:

- (a) One lamina above
- (b) One lamina below
- (c) Approximated but not fused
- (d) One lamina narrowed and shorter.

4. Variations in the articular facets:

The most common of these congenital anomalies is increase in size of one or both of the transverse processes of the fifth lumbar vertebra, sacralization. The unilateral sacralization of the transverse process is more common than the bilateral, though the latter occurs with considerable frequency.

The next most frequent anomaly, at least



Fig. 7. Illustrating bilateral sacralization of the fifth lumbar vertebra, with bilateral pseudo-sacral foramen. This was encountered during a urological examination.



Fig. 8. Illustrating narrowing and shortening and some upward tilting of the transverse processes of the fifth lumbar vertebra. This was encountered during urological examination.

in our cases, has been the narrowing of the transverse processes and the narrowing of the processes with an upward tilting. It is necessary to bear this anomaly constantly in mind, as frequently one is called upon to decide whether this is due to an injury or to an anomaly. It is also not uncommon to find lines of decreased density caused by the pull of the deep muscles of this region, which simulate a fracture. If such a line were encountered, plus the upward tilting of the transverse process, it might easily lead to the erroneous conclusion that the patient had sustained a subperiosteal fracture either old or recent.

Another type of variation in the fifth lumbar is a failure of fusion of the laminae of the spinous process. One lamina may be higher, lower, or the two may be in approximation, though not fused; also, one lamina may be narrower and shorter than the opposite one. This anomaly is not uncommon and quite frequently is associated with sacralization of the transverse process. If

one anomaly is encountered in the fifth lumbar, it is often associated with other congenital variations. These changes are considered by many authors to be incomplete spina bifida. However, none of the changes in the bones and soft tissues of a pure spina bifida are encountered in the above described condition.

Variations in the position and angle of the articular facets are numerous. These may consist in an asymmetry of the development of the facet, one being smaller or larger. Again, the articular surface of one facet may be angulated differently from the one on the opposite side. At times, the joint space may be very clearly seen on one side while it cannot be seen at all on the opposite side. These changes lead to much confusion and have at times been incorrectly diagnosed as fractures. These variations in the facets are difficult to detect because a scoliosis will change their appearance, as will posture, so that one must be meticulous in requiring that the patient lie on the table straight, and,

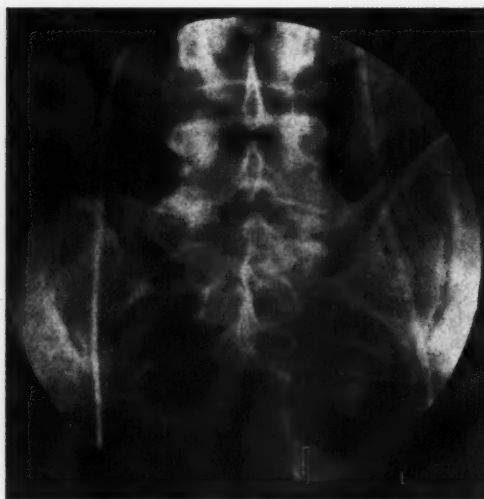


Fig. 9. Illustrating narrowing and marked elongation of the transverse processes, with upward tilting on the left and calcification of the iliolumbar ligament on the right.



Fig. 10. Illustrating narrowing and shortening and slight upward tilting of the transverse processes of the fifth lumbar vertebra. Note that this vertebra also shows slight variation in the inferior articular facets.

also, that the central ray pass through the vertebra at right-angles.

This brings us to technic, which we will dismiss in a few words. As long as the patient is as straight on the table as it is possible for him to be, and the ray is accurately centered over the fifth lumbar, the position is not essential, for one secures a very satisfactory radiograph of the fifth lumbar with the patient prone, as in the examination of the gastro-intestinal tract, or supine, as in the examination of the urinary tract. When, however, an examination of the lumbar spine and sacrum is desired the supine position is naturally the position of choice, as one wishes the part to be examined to be the one nearest the film.

To demonstrate the relation between the transverse processes and the iliac crests the ray should be directed upward at a 45-degree angle.

Stereoscopic examination, though often of the greatest possible assistance, is not essential. The direct lateral is by far the

more important. Here, again, one must exercise great caution that the patient lies directly on his side and that the ray passes through the lumbosacral joint at right-angles.

All of these examinations should be made on the Potter-Bucky diaphragm, and it is often of great assistance if a small cone be used. There are no definite factors such as voltage, milliamperage, time, and distance to be advocated. It seems better to allow the individual operator to select the technic best suited to his needs. One point, however, should be stressed, which is that from one-half to one millimeter of aluminum should always be superimposed as a filter between the patient and the tube.

Having considered the congenital anomalies and arrived at the conclusion that there must be an average standard normal fifth lumbar vertebra, we will briefly enumerate the pathological changes encountered in the fifth lumbar vertebra.

In order that the roentgenologist may be



Fig. 11. Illustrating narrowing of the transverse processes of the lumbar vertebrae. Note that the laminae of the spinous processes are also narrowed and that the right is narrower than the left. There is also an abnormality in the spinous processes of the first segment of the sacrum, showing that numerous congenital anomalies are often associated.



Fig. 12. Illustrating the impinging of the left transverse process of the fifth lumbar vertebra on the ilium. This film was exposed with a 45° upward direction of the central ray.

able to give a comprehensive interpretation of his findings it is necessary to have a routine for examination of the spine.

First, it should be our aim to educate our clinical consultants so that they will give us specific information as to what portion of the spine they wish us to examine, and localize the area as accurately as possible by their physical examination, thus assuring not only economy in time and expense but a better examination and more information from the roentgenologist.

In the actual interpretation of the roentgenograms of the spine in any portion, we must consider what Baetjer terms the "laws of probabilities as to sex and age."

In regard to sex, one will find fracture and other evidences of injury more frequently in the male than in the female. Again, in the lateral projection, the angle between the fifth lumbar vertebra and the first segment of the sacrum is slightly more

acute in the female than in the male, because of the greater depth and width of the female pelvis.

In regard to age, if we are examining a child the stages of development of the epiphysis will be encountered, whereas in the adult one may expect to find the changes incidental to advancing age, namely, roughening or irregularity of the joint surfaces; narrowing or beginning narrowing of the intervertebral discs; so-called lipping, and other evidences of arthritic changes of the margins of the bodies; beginning loss of detail in the trabeculae in the bones, and a tendency to calcification in the intervertebral discs.

In addition to the changes incident to age and sex we must consider postural changes. Such changes in adults, especially in laborers, are common and result from muscle exertion. At times these postural changes may result from faulty carriage or posture acquired by children, who either sit hunched over their desks in school or acquire a slouch from rapid growth and timidity



Fig. 13. Illustrating the bilateral impinging of the transverse processes on the ilium.



Fig. 14. Illustrating non-fusion of the laminae of the spinous processes of the fifth lumbar vertebra, with the one on the left side shorter and lower than on the right and a beginning sacralization of the left transverse process.

about their height. There are other postural changes which develop entirely apart from both occupation and habit, such as those from rickets, occurring in infancy, which produce exaggerated physiological curves of the spine, causing slight wedging of one or more of the vertebrae. These changes due to sex, age, and posture do not apply to the fifth lumbar vertebra exclusively, but are noted in all the vertebrae.

Likewise, we would like to mention one point which applies to the entire spine as well as to the fifth lumbar vertebra, which is of paramount importance in differential diagnosis of disease conditions in the spine, namely, that if one sees, when examining a lesion of the spine, that a body or bodies are involved and the intervertebral discs are clear and of the usual width, one knows that this is pathognomonic of malignant disease. If, on the other hand, the cartilage of the intervertebral disc is destroyed, one knows that the condition is due to injury, tuberculosis, or some other type of infection, because malignant disease, be it sarcoma or carcinoma, never involves the cartilage.

The disease processes which involve the fifth lumbar vertebra are practically the same as those that involve the other portions of the spine. Probably the rarest disease encountered in the fifth lumbar vertebra is tuberculosis, the so-called "Pott's disease," which seems to affect the upper lumbar and dorsal vertebrae with much more frequency. It does, however, occur, as in one case in our series. When present, it shows the same characteristics as noted in the other portions of the spine, namely, an erosion of the body of the vertebra, with a moth-eaten appearance, softening which causes collapse of the body, and involvement of the intervertebral disc, with destruction of the cartilage. This may occur both in the intervertebral disc, between it and the fourth lumbar vertebra, and between the fifth lumbar and the sacrum. There will not, however, be noted the kyphosis seen in the other portions of the spine, though there will be a straightening of the lumbar lordosis.

Osteomyelitis is also a condition of rare



Fig. 15. Illustrating congenital anomaly and non-union of the laminae of the spinous processes of the fifth lumbar vertebra. The one on the left is higher and longer than the lamina on the right.

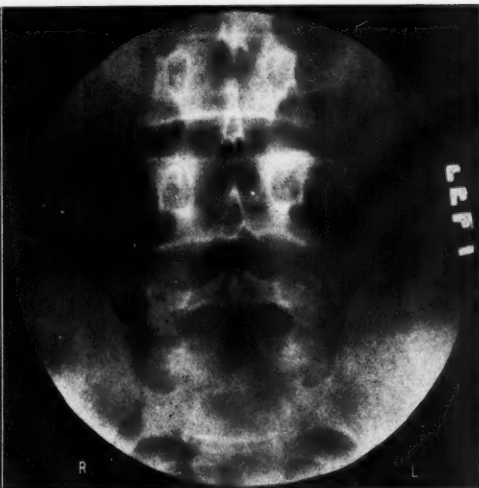


Fig. 16. Illustrating very beautifully congenital anomaly, namely, non-fusion of the laminae of the spinous processes of the fifth lumbar vertebra and laminae in proximation. The left is slightly shorter than the right.

occurrence in the fifth lumbar vertebra. It is here characterized by changes similar to those noted in osteomyelitis in any other bone of the body, with, again, an involvement of the intervertebral disc.

The bone diseases coming under the group of osteitis deformans are not infrequently found involving the fifth lumbar vertebra.

Osteitis deformans causes a condensation of the bone, with irregular distribution of new bone and other changes of decalcification in other bones of the skeleton. The body of the vertebra is definitely increased in density as seen by the X-ray films, and the only condition which is necessary for a differential diagnosis is the osteoplastic type of metastasis resulting from carcinoma of the prostate. This differential diagnosis is sometimes impossible from the radiographs alone, if the other bones in the body are not involved by the osteitis deformans. We must, then, depend upon the history and physical findings.

Osteitis fibrosa cystica may also involve

the fifth lumbar vertebra as well as the other vertebrae and bones of the skeleton. The changes will be very similar to those noted in osteitis deformans except there will probably not be as much evidence of bone production as in the former condition. Here again a differential diagnosis depends upon the other portions of the bony skeleton.

Osteomalacia also involves the bones of the spine and here is characterized by a general decalcification, with no evidence of new bone formation but deformity of the bodies of the vertebrae, including the fifth, as the result of pressure from the weight of the body. The intervertebral discs will not be involved in this condition. In the two previously described conditions they may be involved by arthritic changes.

Malignant disease involving the fifth lumbar vertebra is manifested by two different types, the first of which is the osteoclastic type of metastasis, which shows a decalcification, with destruction of the body of the vertebra, which may involve one portion of



Fig. 17. Illustrating congenital anomaly in lack of fusion of the laminae of the spinous processes of the fifth lumbar vertebra. In this case the laminae on the left side is wider and lower than that on the right. This also illustrates non-fusion of the spinous processes of the first segment of the sacrum and the fourth segment of the sacrum.



Fig. 18. Illustrating asymmetry in the inferior articular facets of the fifth lumbar vertebra. The one on the left is smaller and shorter and on a higher plane than that on the right.

the vertebra in the beginning and later the entire vertebra. The striking feature of this condition is that the intervertebral discs are always normal, both between the fourth and fifth lumbar vertebrae and the fifth lumbar vertebra and the sacrum.

The osteoplastic type of metastasis causes very definite eburnation and the body of the vertebra appears very white and dense when viewed on the roentgenograms. There is no destruction of the body in this condition and its normal contour in outline remains the same.

In our experience we have never encountered a sarcoma involving the fifth lumbar vertebra. This, of course, does not rule out such a condition.

One would expect to find in sarcoma the typical picture of sarcoma involving the other bones, with possibly the sun-ray distribution of the spicules of new periosteal bone. There would, of course, be a destruc-

tion of the body. The other types of sarcoma, such as endotheliomyeloma, have been known to attack the fifth lumbar vertebra. Here they show the characteristics of this tumor in other portions of the skeleton.

Multiple myeloma involves the bones of the spine but only as a very late development in this type of bone tumor. Probably the commonest disease encountered in the fifth lumbar is the so-called hypertrophic osteoarthritis. This is characterized by roughening of the articular facets, the upper and lower margins of the bodies, and, as the process continues, the formation of osteophytes or so-called "hooklets" on the margins of the articular surfaces—also associated with a narrowing of the intervertebral discs.

INJURIES

Let us consider the question of injuries. If we stop to consider the construction of the fifth lumbar vertebra and consider the



Fig. 19. Illustrating asymmetry in the development of the articular facets; also the joint line on the right side in the articulation of the lumbar vertebra and the sacrum, whereas on the left the articular line cannot be made out.

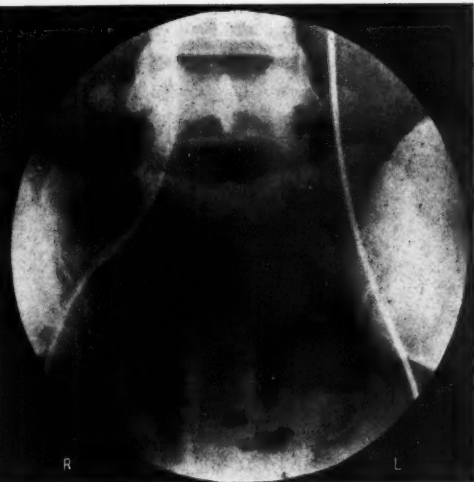


Fig. 20. Illustrating the very small inferior articular facets sometimes encountered when examining the fifth lumbar vertebra. Their articulations with the articular facets of the sacrum are fairly normal.

fact that it is placed in a position between the ilia and on top of the sacrum and supported by large tendons and muscles, we will realize that fractures of the body of this vertebra are rare and can be caused probably only by very severe direct violence. In marked crushing injuries of the pelvis, when the patient sustains ring fractures and dislocation of the bones, it is very rare to find the fifth lumbar vertebra involved. Probably the most frequent injury encountered is a fracture of one of the transverse processes. We can see that this would probably be the most frequent injury, when we consider that marked bending to one side forces the transverse process against the ilium and in this way causes a fracture. Of course, compression fractures of the body of the fifth lumbar vertebra do occur, but with not nearly the frequency that is encountered in the bodies of the dorsal and other lumbar vertebrae. At times one sees a fracture through one side of the body of a lumbar vertebra. This, however, is again very rare and is

probably caused by a lateral bending injury.

All of the conditions described above are causes of low back pain. It is common, however, to examine patients with such a symptom, to be able to rule out injury and disease, and yet the patient may continue to have this annoying symptom of pain. How, then, is this to be explained? There have been, and still are, heated arguments raging over the question of sacro-iliac subluxation and sacro-iliac disease. One feels no hesitancy in admitting that the latter is unquestionably a pathologic entity. However, an establishment of the diagnosis by the use of the roentgen ray is a very doubtful procedure. It is not uncommon for the roentgenologist to discover what appears to be definite changes in the right sacro-iliac joint, yet much to his chagrin to find at operation that the left sacro-iliac joint is diseased and the right normal. Also, normal-appearing sacro-iliac joints on the roentgenogram may be found at operation to be diseased.

The author wishes to state emphatically



Fig. 21. Illustrating another type of congenital anomaly clearly showing a developmental anomaly in the body of the fifth lumbar vertebra. Note that the right lateral mass is much larger than the left. This also illustrates lengthening of the transverse processes, with impingement upon the sacrum.



Fig. 22. Illustrating the apparent asymmetry in the lower articular facets of the fifth lumbar vertebra, and showing how easily one may become confused as the apparent asymmetry in development is probably not a developmental change but due to a rotation of the body of the fifth lumbar as the result of a scoliosis and rotation of the lumbar vertebra above.

that he has never discovered a subluxation of the sacro-iliac joints in the absence of associated fracture of the sacrum, ilium, or other pelvic bones, and further, that he does not believe that sacro-iliac dislocation ever occurs in which there is no fracture of the other pelvic bones.

This brings us to the consideration of a condition which is found to be much more common than was previously thought to be the case, and which in the writer's opinion is one of the greatest, if not the greatest, cause of low back pain. This condition is a forward displacement of the fifth lumbar vertebra upon the sacrum, and is known as spondylolisthesis. Other conditions, such as postural and developmental changes, deform the fifth lumbar vertebra but do not cause dislocation. Rokitsansky, Kilian, and Spaeth have advanced theories as to the etiology of this lesion. Many others have made observations to explain its occurrence. Eighteen

such cases appear in the literature from 1838 to 1892, and there are unquestionably numerous other cases which have not been reported.

Lamblé's investigation offered as proof of this spondylolisthesis, congenital malformation, connected in some way with fetal hydrorachis. Sir Arbuthnot Lane more recently has claimed that it may possibly be an acquired deformity due to excessive weight-bearing. Neugebauer's theory is that imperfect ossification of the laminae or spinous processes of the fifth lumbar vertebra is frequently found in this condition. It is also true that the laminae are ununited to the pedicles. This is substantiated by the fact that spondylolisthesis is often found in children of varying ages. George cites that he has found it in children as young as seven years of age.

One must admit that repeated trauma over a period of time might produce such a



Fig. 23. Illustrating an osteoplastic type of metastasis involving the second lumbar vertebra. Note the marked increase in the density of the vertebra.



Fig. 24. Demonstrating primary osteogenic sarcoma of dorsal spine. Note the non-involvement of the intervertebral discs, which is characteristic of malignant disease of the spine.

condition, but trauma sufficient to displace a lumbar vertebra, especially the fifth, would bring this fact very forcibly to the attention of the patient or his family, if the patient is a child; whereas, in many of these cases in children no history of a trauma severe enough to cause this anterior displacement can be elicited.

George and Leonard in their comprehensive monograph classify these cases in three groups, which three groups we shall take the liberty of quoting here.

(1) Cases in which there are congenital anomalies. (Series of cases of children without exception have shown a defective lamina or spinous process, congenital in origin. In the adult cases, we consider congenital anomalies of the laminae and spinous process the most frequent anatomical observation.)

(2) Cases in which there are no anatomical defects or anomalies but a history of direct trauma.

(3) Cases in which there is a history of direct trauma and a congenital anomaly of the bony structure of the fifth lumbar vertebra. This may also occur from anomalies

in the articular processes of the sacrum with the fifth lumbar vertebra.

One would think that the non-locking type of articulation would be a common contributory cause to this anterior slipping, but we find in studying a large series of cases that this type is of such frequent occurrence that it minimizes this possibility. A study of the articular processes in serious injury would show that the abnormal or non-locking type occurs as frequently as what we consider the normal or locking type.

We should consider first the mechanics of this region. Normally, these articulations do not bear weight, being merely guiding planes on which gliding motion takes place. In the lumbar region there are definite inter- and external articular processes in the sagittal plane to check rotation. However, at the lumbosacral junction Nature has attempted to increase motion by adding more or less rotation.



Fig. 25. Illustrating compression fracture of the fifth lumbar vertebra. Note collapse of body.

The fifth lumbar vertebra is placed in a precarious position because it is at the junction of the mobile spine and the immobile sacrum and at the point at which a sharp change in the direction of the spinal column takes place, and, as flexibility and strength are always opposed, added rotation further jeopardizes the joint.

By inclining the articulations outward, thus approximating the antero-posterior type of articulation found in the thoracic region, rotation is gained. However, when these articulations are asymmetrical they result in unequal rotation, which also contributes to weakness of the part. Furthermore, when these articulations are associated with a poor muscular or ligamentous development, or if there is a settling down on these articular processes from any cause, a very potent reason for disability or abnormality is established.

Mills considers the type of articular processes in the lumbosacral region as etiologic in certain cases of scoliosis. According to Hibbs, it is evident that fractures and dislocations in this region are practically always the result of rotating action, regardless of



Fig. 26. Antero-posterior view illustrating old Pott's disease involving the fifth lumbar vertebra, with destruction of the body and the intervertebral discs, and complete ankylosis of the third, fourth, and fifth lumbar vertebrae and the sacrum.

how the force is applied. The lumbosacral junction carries all the superimposed weight of the body, because the center of gravity of the body is approximately in the upper lumbar region and the weight-bearing line of the spinal curves. Normally the body weight is carried entirely on the first sacral body and not on its articular processes. Pelvic tilts and movements cause a shifting of the weight to other parts of the body. They never decrease the weight but at times it is increased by these changes in position or by the added strain of lifting and weight-bearing. This increase in weight by changes in position is best illustrated by a lever on a fulcrum. If the lever is placed horizontally over the fulcrum so that it is balanced, the force will be a certain amount. However, if the lever be moved so that one arm

is extended farther out and the horizontal position be maintained by balancing from the short end, we find that the pressure is considerably increased, depending upon the difference in length of the two arms of the lever.

The lumbosacral joint presents a similar condition. The full effect of the weight is transmitted to this juncture regardless of the position of the weight. This is converted into a shearing strain between the fifth lumbar and the first sacral bodies. This shearing force is controlled alone by the angle of the superior surface of the sacrum.

From the above one can see that any increase in the sacrovertebral angle increases the shearing strain and the tendency of the fifth lumbar vertebra to slip forward or forward and sideways because of the increase in the shearing strain. Other factors which normally tend to counteract this instability are muscles in tone, which are important aids and by their action with the ligamentous attachments maintain as perfect a balance over this joint as is possible.

The ordinary ligaments of fibrous tissue in themselves are of limited value, because they must be sufficiently relaxed to allow motion. The most important ligaments are the elastic interspinal and the interlaminal, the latter more especially. They not only resist exaggerated motion and displacement of the vertebrae, but, if this should take place, tend to draw them into normal position again.

The intervertebral discs are the most important bonds of union between all the vertebrae, but especially between the fifth lumbar and the sacrum. They act as effective shock absorbers, but this action is somewhat diminished in the disc between the fifth lumbar and the sacrum, as it is narrowed posteriorly, due to assuming the upright position. Another factor in stabilization is the shape of the first sacral segment. In an attempt to create a good platform for the fifth lum-



Fig. 27. Illustrates extensive hypertrophic osteoarthritis, with bony bridging and hooklet formation.

bar to rest on, a platform from which there will not be too great a tendency to slide, Nature has so constructed the first sacral body that it is nearly always built out under the fifth lumbar to some degree, thus partially nullifying the effect of the sacrovertebral angle and greatly diminishing the shearing stresses. The extent of the lordotic curve of the lumbar region is determined by the shape of this body plus the shape of the fifth lumbar vertebra.

The spinous processes and the laminae are also of importance in stabilization. The closer they are to each other the shorter and stronger are the ligaments, giving more stability to the part. The spinous processes, because of freer motion at the lumbosacral junction, are comparatively small and at a greater distance from each other than in other parts of the spine, but when abnormally there is contact between the processes in

this region a definite source of pain is created.

There may be partial or complete absence of the neural arch of the first sacral, resulting in a part of distinctly lessened stability because of thinner and longer ligaments. It

joint which normally is more or less unstable is made increasingly so by anything which by its unequal or abnormal development creates abnormal or asymmetrical motion.

In Morris's "Anatomy" the sacrovertebral

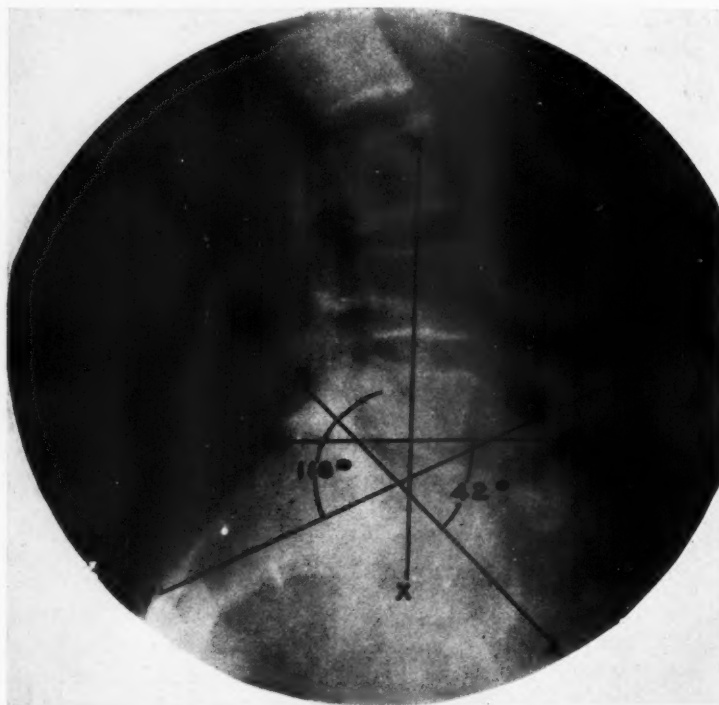


Fig. 28. Chart of lateral lumbar illustrating the method of obtaining the lumbosacral angle and also the angle made by the superior surface of the sacrum from which the shearing strain is determined. The line "X" is the vertical upright, approximately the line of spinal weight-bearing. Line "Y," approximately the center of the first two sacral bodies. The intersection of the lines "X" and "Y" gives the lumbosacral angle. The line "B" is a horizontal line running through the uppermost limit of the body of the first sacral segment. Another line "A" is that drawn through the superior surface of the first sacral segment. This gives the angle made by the superior surface of the first sacral segment, and it is from this angle that the shearing force is determined.

has been estimated anatomically that about 15 per cent of all persons are so affected. Occasionally cases are encountered that show a non-fusion of the first sacral body to the second and which clinically exhibit more or less motion. Such types of incomplete development are frequently characterized by lumbosacral pain and disability. A

angle is given as 117 degrees in the male and 130 degrees in the female. This angle depends on the pelvic obliquity, which averages, according to Morris, 155 degrees in the male and 150 degrees in the female. The above is of value only from an anatomic point of view, the important angle being that obtained from the plane of the su-

terior surface of the first sacral and the horizontal, because on it rests all of the actual effective strain. This angle varies from 28 to 80 degrees and averages about 42.5 degrees.

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sorption, or foci of infection including the teeth, tonsils, sinuses, gall bladder or other points.

Traumatic conditions, as the name implies, include those forms of backache which are the results of direct trauma.

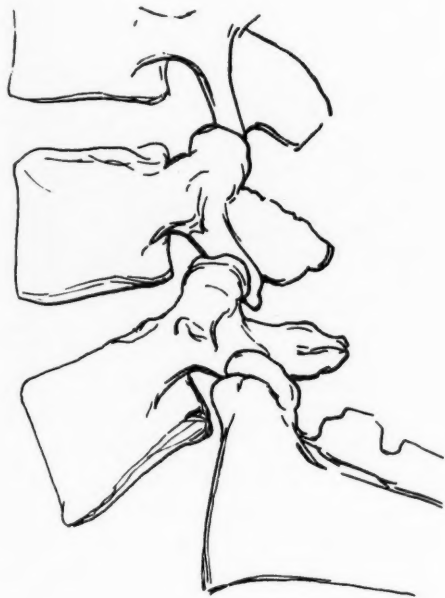


Fig. 29. Tracing to demonstrate the displacement of the fifth lumbar vertebra forward, with a marked increase in the normal angle and break in contour of the neural canal.

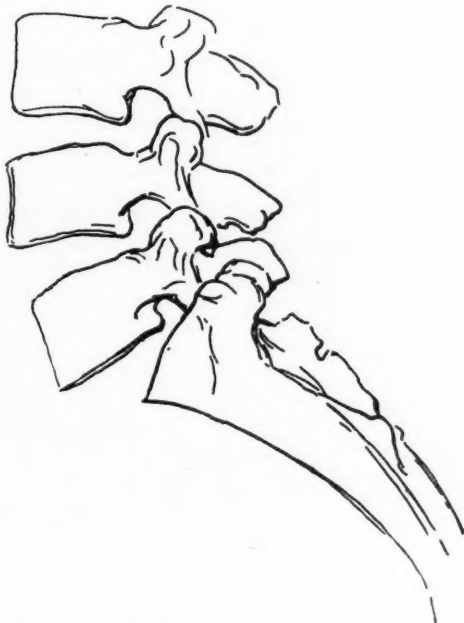


Fig. 30. Illustrating a more advanced case of anterior displacement of the fifth lumbar on the sacrum and a greater exaggeration in the break in outline of the neural arch.

a committee to investigate backache. Their report² is based on a questionnaire which was sent to 250 leading American orthopedic surgeons. The Committee's summary of the replies received to this questionnaire shows, as is to be expected, that there are many opinions on low back pain, but on the whole there is a fairly definite agreement as to the main causes of backache, which they state have been proven to be, broadly, arthritis, trauma, and posture.

Arthritis may include osteo-arthritis, and the toxic conditions due to intestinal ab-

Postural backache is due to static errors resulting in muscular and ligamentous strain due to improper alignment.

The so-called anomalies of the fifth lumbar vertebra and the first sacral segment described above can reasonably be put in the postural group. They in themselves probably do not begin to cause pain until their alignment has been disturbed by trauma, which may be entirely disproportionate in severity with the resulting disability, or as a result of postural defects.

Although these three types are apparently clearly differentiated they are in reality closely associated and one form may induce

²Jour. Bone and Joint Surg., April, 1928, X, 290.

one or both of the others, so that in chronic backache all three may have played an important part.

Much has been written and many explanations given, but one may state without fear of contradiction that we have made very



Fig. 31. This tracing illustrates a very extreme case of forward displacement of the fifth lumbar vertebra and is really almost a subluxation.

little, if any, advance in our knowledge of this subject. Excluding the definite findings of disease or injury to the lumbar vertebrae which we will admit are a cause of backache, we feel that, viewing these problems purely from a roentgenological standpoint, we cannot account for backache by the roentgen findings in these cases of anatomical variations from the accepted standard normal. This conclusion is forced upon an experienced observer by the fact that these variations in development occur with surprising frequency and are so very commonly encountered in patients who do not have low back pain. Further, we know that all of these patients showing developmental anomalies have had them since birth. Then why is it they have gone years without backache?

Then why, with no severe trauma and with no change in the condition of the anatomical variations as demonstrated on the radiograph, should they suddenly develop backache?

Spondylolisthesis, as stated above, is, in the author's opinion, a frequent cause of low back pain; yet even in this condition patients are seen who, showing a marked spondylolisthesis, have no backache.

In conclusion it is obvious, therefore, that it is not within the province of the roentgenologist to voice an opinion that the developmental change or the spondylolisthesis encountered in the individual case is the cause of that individual's backache, especially when we consider the complicated arrangement of the ligaments and muscles in the lumbosacral region.

We venture to predict that the explanation of low back pain, in the cases in which the roentgen examination excludes fracture and disease as causes, though it may demonstrate developmental variations and even spondylolisthesis, will be reached by study of the arrangements of the ligaments and deep muscles and the mechanism of the lumbosacral region and not by the roentgen examination.

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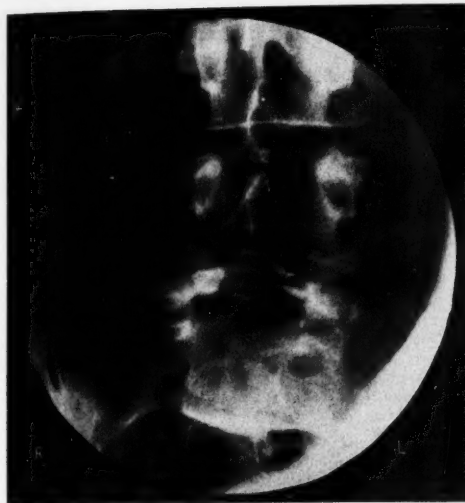


Fig. 32. Illustrates the anterior tilting and slight displacement of the fifth lumbar vertebra as viewed in the antero-posterior position.

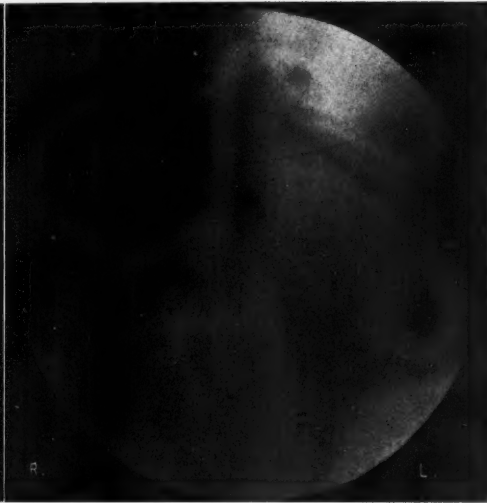


Fig. 33. Illustrates the same case, as viewed in the lateral position. Note the marked increase in the lumbosacral angle and slight anterior displacement of the fifth lumbar vertebra on the first sacral segment.

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Fig. 34. Illustrates a generalized osteitis fibrosa cystica involving the lumbar spine and bones of the pelvis.

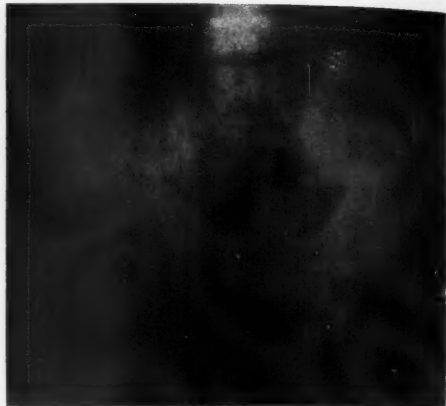


Fig. 35. Illustrates the changes of osteitis deformans in the lower lumbar spine and bones of the pelvis.

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DISCUSSION

DR. H. P. DOUB (Detroit, Michigan): This is a timely subject and one which merits considerable study—I do not believe

that too much information can be gathered concerning it. It is a very difficult thing to tell, in individual cases, the cause of a patient's back pain him.

I believe that a uniform technic is an important thing in these cases. In the first place, of course, one should take a stereoscopic film in the postero-anterior position. Recently we have taken them at about 45 degrees, whereas we had been using 25 degrees. In using the 45-degree angle, you get a truer picture of the fifth lumbar vertebra—good detail, of course, goes without saying.

It has been my custom to distinguish between sacralization, wherein the lateral processes of the fifth lumbar vertebra are ankylosed to the top, and what I call pseudosacralization in cases in which they do not become fused. I believe that in cases in which they are fused, one should not attribute too many symptoms to the condition. If they are not fused, the matter is left open to question. Personally, I do not attribute many symptoms to this condition.

In spondylolisthesis I have always felt that there must be some congenital abnormality in the articulation to allow this to take place. It is a strong articulation if there are no abnormalities present and I doubt if it takes place when the bones in this area are normally formed.

DR. L. T. LeWALD (New York City): This paper, as Dr. Doub has just said, is very important. Dr. Belden called attention to the possibility of mistaking a condition such as Paget's disease for secondary malignancy. I have seen that happen in several instances, where diagnoses had been made of secondary carcinoma, suggesting disease of the prostate or breast as the primary lesion, and further examination by the clinician has failed to show any primary disease. And I have seen cases in which the patient had primary operable disease and the

operation was held up because of *supposed* secondary carcinoma, which did not really exist. In one case, carcinoma of the transverse colon, associated with suspicious appearances in the lumbar vertebrae, was diagnosed by two roentgenologists as secondary carcinoma. The proposed operation was cancelled. The case was then referred to me and I decided that the operation should not be held up. The carcinoma of the colon was resected, and now, a year later, the only complaint of the patient is that she is getting too stout.

I think Dr. Belden also showed one case of a lesion in the seventh dorsal. In cases with a history of traumatism, one has to be very cautious in the diagnosis of a compression fracture, where the condition is really due to a maldevelopment of a dorsal vertebra. I have watched some of these cases for a considerable time and have seen no changes, and in one or two of them there has been no history of trauma. One has to be very guarded in his interpretation of an abnormal vertebra in this region. Also, the late senile and so-called occupational changes and those due to osteoarthritis, with peculiar partially collapsed vertebrae, should be observed for some time and an attempt made to correlate any real traumatism with the so-called lesion. I have one case now, in which instance no attention was paid to the region of the trauma—the patient was struck on the head. I think there were three narrowed vertebrae, together with marked osteoarthritis, and an attempt has been made to attribute these changes to the trauma on the head, which, of course, is an error.

DR. WRIGHT (Toronto, Ontario, Canada): I have been studying the question of the fifth lumbar vertebra and the sacroiliac region from the radiological standpoint and the orthopedic, and I may say that gradually the orthopedic standpoint has pre-

dominated. Dr. Belden admits that in the fifth lumbar vertebra there are many anomalies, and that one cannot interpret them from the symptom of pain as a guide, because there is much involved in the subject which is not known. From the orthopedic standpoint I could bring you X-ray films which show definite displacement of the sacro-iliac, with separation of the symphysis, in which there is no fracture of the pelvis. I have seen cases in which the X-ray film shows nothing definitely abnormal, while clinically there is pain and one or more definite signs of a mechanical traumatic lesion. A manipulation elicits an audible cracking sound. The clinical signs, including the pain, disappear. The patient is well and happy, though we have not cured him by suggestion. The conclusion must be that there is present a lesion which cannot be demonstrated by the X-ray. Therefore, I say that the radiologist goes too far afield in saying there is no lesion of the sacro-iliac joint because he cannot see one on the radiograph.

DR. BYRON H. JACKSON (Scranton, Pa.): For a good many years we have been hearing papers about the sacro-iliac joint. I heard one in Chicago some years ago which ended just where we are now. We admit we can never tell anything about the fifth vertebra until we all make our roentgenograms in the same way. I would like to suggest a method which in my hands appears satisfactory, and I would like you to try it, to see if you do not get your views of the spine always in the same way.

My great difficulty has been in holding the patient still. When you turn the patient on the side, you have many factors which change the position of the spine. This is the way we do it: We lay the patient on a board about seven feet long, on the table. The board extends over the table a little so

that it can be lifted. This board is then elevated five inches and held in this position by blocks. The Bucky diaphragm is fastened to an old tube stand, and can be lifted up and down and turned to make the lateral views with the patient lying on his back. The only thing one has to say to the patient is, "Don't move." One can set the Bucky diaphragm four times, the patient not moving, and one can get any sort of film he wants; for instance, for 400 ma.-sec. while the patient lies on his back.

DR. BELDEN (closing): As Dr. Doub has said, I feel that the stereoscopic examination of the fifth lumbar vertebra is of great importance, but I also feel that the lateral projection of the fifth lumbar is of even greater value and should never be omitted in an examination of this region.

We were probably too dogmatic in making the statement that a sacro-iliac dislocation never occurs without injury to the other bones of the pelvis. In the case cited in the discussion, it would seem that this contention was borne out in that the dislocated sacro-iliac joint was associated with the widening of the pubic joint. This is certainly evidence that there must have been some other injury to the pelvis. It has never come within my experience to see a displacement of the sacrum in regard to the ilium without demonstrating injury to the other bones of the pelvis.

One cannot come out flatfootedly and say that there is no displacement or subluxation of the sacro-iliac joint because the X-ray examination is negative. It would seem better to qualify this statement and say that the X-ray examination does not show any variations from the normal, but that this does not rule out a slight slipping in the sacro-iliac joint.

In Dr. Jackson's discussion he brought out a splendid point, that of radiographing

the lumbar spine laterally with the patient in the supine position. I, for one, am going to try this with a great deal of enthusiasm,

and hope that we will have much better results, particularly as to the anatomical relation of the parts.

The Diagnosis of the Mesenterium Commune. Theodor Weiss. *Röntgenpraxis*, Aug. 1, 1930, II, 697.

Four cases are described, in which a mesenterium commune could be demonstrated roentgenologically. This congenital anomaly is characterized by the fact that the duodenum does not rotate towards the left, but that it goes into the jejunum in the midline or on the right side, and that the ascending colon is found in the midline and not on the right side. The importance of the roentgenologic diagnosis for the clinician is emphasized.

H. W. HEFKE, M.D.

Birthmarks and Their Treatment. Gunnar Andrén. *Röntgenpraxis*, Sept. 1, 1930, II, 794.

One hundred and eighteen cases of hemangiomas, treated between 1909 and 1924, with radium at the Radiumhemmet, are reported. Seventy per cent of them showed cosmetically good results, and in 30 per cent considerable improvement was noted. In no case did a secondary radium atrophy take place. Six-

teen cases were cured after only one treatment. Children with hemangiomas should be treated as soon as possible after birth, because the hemangioma often grows considerably in the first few weeks. Roentgen therapy should not be tried, as it is inferior to radium therapy. Forssell's technic was used, giving only relatively small doses of radium spread over a long period of time and with long intervals. This technic is the only means of getting good cosmetic results.

H. W. HEFKE, M.D.

Bilateral Disease of the Os Naviculare Pedis in Adults. A. Wilke. *Röntgenpraxis*, August 15, 1930, II, 751.

In a sixty-year-old woman a bilateral narrowing of the os naviculare was found on the roentgenogram, the appearance of which suggested Köhler's disease. The history dated back for many years, and the author believes this diagnosis to be most probable. Only three such cases have been described in the literature.

H. W. HEFKE, M.D.

UROSELECTAN AS A MEDIUM FOR VESICULOGRAPHIC STUDY¹

A PRELIMINARY REPORT

By ERNEST G. MARK, M.D., KANSAS CITY, MISSOURI

RADIOGRAPHIC study of the vasa, vesicles, and ejaculatory ducts has been abortively attempted during the past seventeen years. With the exception of the work of Sargent (1), who, in 1929, reported on over two hundred cases in which vesiculography had been done, there is no illuminating study in the literature. This we believe to be due to two factors: (1) The difficulty of so injecting the seminal tract as to procure the essential pictures; (2) the difficulty of securing a proper medium for injection.

In 1905, Klotz (2), of New York, first suggested and accomplished injection of the ejaculatory duct *via* the endoscope. Eight years later, in 1903, we (3) presented a urethroscope using air inflation through which we were enabled to accomplish the same purpose, using a specially constructed silver canula having a shouldered tip. Credit was not given Klotz at this time as we were unaware of his work. In 1913, Belfield (4) published a short article on the subject of vesiculography in which injection was done through a vasostomy wound. In 1918, Millstone (5), in a brief article, reported on vesiculograms done through a vasostomy incision. This writer made use of a 10 per cent collargol solution, as suggested by Belfield. The amount of medium used varied from 10 to 30 cubic centimeters.

In 1920, Young and Waters (6) again demonstrated the possibility of injection of the ejaculatory duct through the urethroscope. No mention was made by them of any former work of this character. Roentgenograms were made, using thorium as a medium. In 1926, Belfield and Rolnick (7),

using iodized oils through an incision in the vas, were able to secure some excellent vesiculograms. Sargent, referred to in the beginning of this article, made use of similar oils. Belfield and Rolnick state that 20 per cent sodium iodide and 10 per cent sodium tetraiodophenolphthalein gave relatively poor shadows as compared with collargol in 10 per cent solution or thymol iodide combined with cod liver oil. They warned against the use of the iodized oils in tuberculosis of the genital tract, as did Sargent. The same writers state that the viscosity of lipiodol or iodipin makes their use unsuitable for vesiculography. Sargent further states that the tendency of the iodized oils to remain in the vas and vesicle over a long period of time, with a possibility of such media becoming the nuclei of foreign bodies, constitutes a contra-indication to their use. Again, catheterization after injection for the purpose of obtaining a clear field in the prostatic urethra and bladder base failed to withdraw the oil, with consequent non-differentiating shadows. He estimates by means of a series of radiographic studies that where there is no obstruction in the ejaculatory ducts, emptying occurred in from two to five days, though this period might be markedly increased where there was pathology in the wall of the vesicle or where the ejaculatory ducts showed varied degrees of obstruction. In one instance in his series the shadowgraphic medium was observed to persist up to as long as three weeks.

Sargent further proved conclusively that vasostomy, using non-irritating substances for injection, failed to produce in any instance obstruction of the vas or ejaculatory

¹From the Diagnostic Clinic of Research Hospital.



Fig. 1. Case of hematospermia. Radiogram taken immediately after injection. Bladder not catheterized. Ballooning of right vesicle, with loss of ramifications. Some blockage of ejaculatory duct on right.



Fig. 2. Same case as shown in Figure 1, thirty minutes later with forced air-inflation of bladder. Ballooning of right vesicle still persists though there has been some loss of shadow-graphic medium. Twenty-four hours later no shadow could be seen.

duct, while Rolnick and others have shown that irritating drugs injected into the vas often give rise to complete obliteration of its lumen. Following the injection of even a $12\frac{1}{2}$ per cent solution of sodium iodide into the ureters and renal pelves, an intense mucosal and submucosal infiltration is observed. One has but to follow his pyelogrammed specimens to the pathologic laboratory to be impressed with the truth of this statement. The use, then, of a 20 per cent solution of the same drug in the small lumen of the vas, with its ramifications and those of the vesicle, must produce a more intense reaction which, with a longer retention of the medium, must logically produce obliterative changes. The objections to the use of lipiodol and like iodized oils have been mentioned above.

With the introduction of uroselectan to the profession for the purpose of intravenous pyelography a wider use for this drug appealed to us. Its use for retrograde pyelograms in 40 per cent solution has, insofar as we have been able to determine in our own work, been totally unattended by the usual reaction following pyelograms using $12\frac{1}{2}$ per cent sodium iodide as a medium. Its (uroselectan's) use in 20 per cent solution has given us far better retrograde pyelograms than when $12\frac{1}{2}$ per cent sodium iodide has been used.

Neither in the intravenous use of uroselectan nor in retrograde pyelography have any disturbances in tuberculous lesions of the urogenital tract been observed. It, therefore, seems to us that in this drug we have the most efficient and at the same time the

least harmful medium for vesiculograms. This has been accomplished through a vasostomy incision (under local novocaine anesthesia, of course), without discomfort to the patient or reaction in the genital tract. A 40 per cent solution has been used, due to the thickness of the area to be penetrated by the ray. We have not used air-inflation of the rectum together with air-inflation of the bladder, as has been recommended, the latter procedure having proven quite sufficient for proper differentiation and study. Stereoscopic negatives have been made, as is our custom in all urograms. Where no distinct obstruction has been noted there has been no evidence of the medium in the vas or vesicles at the end of twenty-four hours. As this cannot be explained on the theory of drainage through the ejaculatory duct, based upon Sargent's studies and our own clinical experience, we are forced to the conclusion that an absorption of the drug has taken place.

It has long been recognized that if, in doing a vasostomy for either therapeutic or diagnostic purposes, there is injected into the sheath of the vas or surrounding tissues any of the media heretofore used, marked reaction followed. This is especially true of collargol and sodium iodide, and, while the iodized oils do not produce the discomfort or tissue destruction observed with the above named drugs, they nevertheless act as foreign bodies. Uroselectan, if injected subcutaneously, produces no reaction and is readily absorbed.

In a very large percentage of the cases in which vesiculographic study is indicated, the posterior urethra, and especially the verumontanum, show such pathologic changes as to preclude injection through the urethroscope by the method of Klotz.

We are convinced, in fact, that vasostomy as a rule is productive of less trauma and discomfort than is retrograde injection through the ejaculatory ducts. Certainly, if vesiculography is to be permanently added to our diagnostic methods, vasostomy will prove by far the more simple and widely accepted procedure. The introduction of uroselectan has given us a perfectly safe drug in every particular for this work. On account of its rapid absorption, films in series over a period of days cannot be done.

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IRRADIATION THERAPY IN FUNCTIONAL OVARIAN DISORDERS¹

By FRANCES A. FORD, M.D., Section on Therapeutic Radiology, The Mayo Clinic,
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ALTHOUGH irradiation of the ovaries or hypophysis with suitable exposures to roentgen rays has been accepted by many of the foremost gynecologists as the most efficient treatment now available for ovarian insufficiency, there are still uncertainties in the minds of many practitioners and radiologists in regard to the optimal dose to be employed, the degree of success and duration of results to be anticipated, and the safety of repeated irradiation. Since these facts can be determined only by accurately reporting various experiences, I have reviewed the cases treated by this method in the Department of Radiotherapy at The Mayo Clinic in the last four years. The series includes forty-seven cases in which treatment has been primarily for habitual amenorrhea or for oligomenorrhea or sterility associated with these conditions, and twenty-nine cases in which treatment has been primarily for dysmenorrhea.

The minimal range of exposure recommended for this form of treatment has been employed. In ovarian irradiation the practice is to apply 15 to 20 per cent of an erythema dose of rays of short wave length, generated at 200 peak kilovolts, filtered through 0.75 mm. of copper and 1 mm. of aluminum, to each of two abdominal fields, approximately 8 by 10 cm. in size, overlying each ovary. With the varying thickness of the abdominal wall it is estimated that the dose which reaches the ovary cannot be over 10 per cent of the erythema dose and that it is often as low as 5 per cent. In irradiation of the pituitary gland small fields have been used, 5 by 5 cm. over each temporal area, to subject the pituitary gland to cross-fire; 15

to 20 per cent of an erythema dose is applied to each field. In contrast to this dosage is the technic of Thaler, and of Momm, who employed for ovarian irradiation approximately one-third to one-fourth of a castration dose, or 18 to 23 per cent of an erythema dose, at the level of the ovaries, and the irradiation for the pituitary gland, used by Werner, who applied 30 per cent of an erythema dose on each lateral cranial field. The method used at the Clinic probably delivers a slightly lower dose of rays than that described by Hirsch and by Kaplan.

AMENORRHEA

Among the forty-seven patients with amenorrhea who have been treated, the ages ranged from nineteen to thirty-seven years, and the usual periods of suppression of menses prior to treatment, from three or four months to six years. Thirty-six patients were treated by irradiation of the ovaries, five by irradiation of the pituitary gland, and five by a combination of both forms of treatment. One patient, treated first by ovarian irradiation, was given a combined pituitary and ovarian exposure after an interval of one month. Report of the result of treatment has not been available from six patients. Fifteen patients failed to react to treatment, or at least subsequent menstruation was so irregular as to be considered the usual type for these patients. In twenty-six patients menstruation was re-established within six weeks after the irradiation. In one of these a single period of flow occurred closely following the irradiation; a second patient, treated two months before this study was made, had had but one period of flow when it ended.

¹Read before the Radiological Society of North America, at Los Angeles, California, Dec. 1-5, 1930.

In two other cases the menses ceased or became irregular after three normal periods of flow. In eleven cases menstruation continued regularly from the time of treatment to the last report, the interval between treatment and report varying from three to nine months. In six cases, regular menstruation continued for from ten months to two years and ten months; the average was seventeen months. The patient to whom combined ovarian and pituitary irradiation was given one month after an ovarian irradiation, had more than two years of regular menstruation, in contrast to only one menstruation in the six years preceding treatment. The patient who had apparently the longest continued effect from treatment was thirty-two years of age when treated. She had had, before irradiation, only occasional scanty flows two to four years apart and had been married seventeen years without a pregnancy. Regular menstruation occurred following the ovarian irradiation used in her case and there have been two pregnancies, with the birth of normal children at full term. One child died of respiratory failure shortly after birth. Menstruation was re-established after both pregnancies and ceased abruptly two years and ten months from the date of irradiation. Among twenty-four married patients who previously were sterile, five, in addition to one just referred to, have been pregnant since the treatment. In two cases of the five the pregnancy terminated by miscarriage, and in one of these two instances regular menstruation returned and continued for one year. In a third case, after a pregnancy of full term, menstruation has been re-established. Two pregnancies were still in progress at the conclusion of the study; one of these occurred within two months of the irradiation, without previous re-establishment of menstruation.

It has been contended that the influence of examinations and the element of suggestion

in any form of treatment may induce a menstrual period even after prolonged suppression. I feel that the proportion of satisfactorily maintained results refutes this criticism. In a series of patients treated by irradiation for amenorrhea, Wieloch occasionally interposed between the roentgen-ray tube and the patient sufficient protective material entirely to prevent any radiation from reaching the patient, the other conditions of treatment remaining the same as though the irradiation were applied. In no instance did a patient of the control series report any imagined benefit from the treatment. In the conditions of the work being reported in this paper, in which the majority of the patients came from a distance and were under additional expense from prolonged visits, it has not been felt that such control studies were justifiable.

I have found that pituitary and ovarian irradiation are equally effective in relieving amenorrhea, although our experience with the pituitary form of treatment is limited. The combined type of treatment has not given a greater proportion of successful results, nor does it seem to have resulted in longer duration of good results, although the individual variations in results are so great that this fact cannot definitely be determined from the number of cases studied. It has been stated that the older the patient and the more prolonged the previous menstrual suppression, the less likelihood there is of successful result from irradiation. Although I have found a higher proportion of failures with irradiation treatment in patients more than thirty-three years of age, I do not attach great importance to the previous periods of amenorrhea. Certain patients experience definite molimen indicative of some ovarian activity through long periods of amenorrhea; others, who suffer relatively little disturbance of menstrual rhythm, but who experience frequent hot flashes, headaches, and psychic changes, may be suffering from a

more serious degree of ovarian insufficiency and may prove less amenable to treatment. The patients with amenorrhea associated with obesity have seemed to react more favorably to irradiation than those of normal or of less than normal weight. Obese patients ordinarily have been able to reduce their weight more easily during the time of normal menstrual function.

I have had little opportunity to test the effect of repeated treatment for amenorrhea or oligomenorrhea. A second treatment has been given in only two instances. One of these, previously referred to, is the case in which the second irradiation was given after a month's interval; in the other a second ovarian irradiation was given one year and nine months after the first, menstruation having ceased in the three months preceding the second treatment. The result of the second treatment has not been ascertained.

In the amenorrheic cases in which objective criteria exist for the evaluation of the effect of treatments, I have carefully avoided suggesting to the patient any associated symptomatic change. The majority of patients, following the re-establishment of menstruation, and one patient whose menses were not re-established, reported definite improvement in general health. Two patients in whom menstruation was re-established experienced complete relief of former, almost constant, severe headaches. Dysmenorrhea, formerly associated with irregular periods, frequently disappeared with the establishment of more regular flow, but one patient stated that with re-established regular menstruation she experienced severe pain for the first time. The improvement in general health might easily be attributable to a sense of satisfaction in the re-establishment of normal function or it might be due to influence of suggestion. Dodds and Robertson, in a study of the relief of amenorrhea by subcutaneous injections of an accurately standardized preparation of estrin, in which

more than 90 per cent of the patients reported great improvement in general health and spirits irrespective of the success in re-establishing menstruation, found that in a control series in which saline solution was injected equally satisfactory reports were given.

DYSMENORRHEA

I have come to regard so-called functional dysmenorrhea as a primary symptom of ovarian insufficiency, chiefly because of the frequency with which it is associated with oligomenorrhea and with the occasional periods in the habitual amenorrheic type, and because of the fact that the condition may occasionally be influenced by the administration of ovarian extracts. It is recognized that pain with menstruation may be caused by other disorders, such as stenosis of the cervix, adenomyomas, endometrioidosis, and pelvic inflammatory disease. In many of the cases dilatation and exploratory operations previous to irradiation had failed to reveal any gross pathologic change.

In judging the results of treatment of dysmenorrhea by irradiation I depend entirely on the patient's report of subjective change. The only check on the reliability of the conclusions is the proportion of similar results obtained. Care has been exercised to avoid as far as possible definite suggestion of anticipated results. For economic reasons previously referred to, no attempt to maintain a control series has been made.

Of the twenty-nine cases in which treatment was given, pituitary irradiation was used in seven instances, ovarian irradiation in three, and the combination of both exposures in nineteen; the therapeutic factors were those previously stated. A second irradiation has been given in ten cases at intervals of from three to seven months after the first treatment. One patient received three irradiations to the pituitary gland at intervals of six months and of three

months. Two patients each have received six irradiations over two and a half and three and a half years, respectively.

One of the twenty-nine patients could not be traced. Two patients have had relief of pain with the period succeeding irradiation, but the duration of the effect has not been established. Ten patients failed to improve after treatment; two of these had the uterus removed in the second month following irradiation, which I now feel, in view of the occasional gradual improvement after irradiation, did not permit of fair estimation of the effect of irradiation. One patient, although unrelieved of abdominal and pelvic pain, had complete relief of intense headaches, and another noted improved regulation of interval and amount of flow although the pain was unaffected. Sixteen patients obtained partial or complete relief of pain. At times the full benefit of the treatment was evident in the period immediately following the irradiation; in other instances the improvement manifested itself gradually, leading to complete relief by the third period. Two patients after a single irradiation were continuing free from pain for more than one year when this study ended. Two others have had, to the present time, complete relief for four months and six months, respectively. One patient, whose relief of dysmenorrhea was only partial, experienced pronounced and immediate improvement of a state of acute depression psychosis.

If pain is not completely relieved by the third month, or if pain returns subsequent to the third month, a second irradiation has been advised whenever the patient has been able to return. The second irradiation has often had more definite and lasting results. Five of a series of patients who received two irradiations were freed from pain from two to four months following the first treatment; the second irradiation produced more complete relief continuing from six months to nine months. One patient had had three

irradiations to the pituitary gland, with periods of comfort of three, six, and five months. Two patients who have been observed over two and a half and three and a half years, respectively, each received six irradiations. One of these patients was given irradiation to the pituitary gland only, and menstruation without pain continued for from three to eighteen months after each exposure. Whereas this patient had previously been obliged to give up her college work and was incapacitated for holding any position, she has since completed a three years' course of nurse's training. Menstruation occurs normally and she is entirely free from pain and the hyperemesis that formerly accompanied each period of flow. The second patient was given both pituitary and ovarian irradiation. The intervals between treatments varied from three months to one year. This patient occasionally experiences pain for one or two hours with the onset of menses, in contrast to her previous experience of three or four days of intense suffering, requiring opiates for relief and necessitating her absence from work for several days each month.

Wieloch, using longer ovarian exposures in cases of habitual amenorrhea (one-third to two-fifths of a castration dose), found, with repeated irradiation at short intervals, that the late results indicated further impairment of ovarian activity. In my experience in the treatment of dysmenorrhea I have never noted this effect.

SUMMARY

With exposure of the ovaries or hypophysis to approximately 5 to 10 per cent of an erythema dose of roentgen rays, reestablishment of menses has been obtained in twenty-six of forty-seven cases. Menstruation has continued regularly in the majority of cases for periods varying from a few months to two years.

Seven pregnancies have occurred among six of the twenty-four married patients in the group, all of whom had previously been sterile. Two pregnancies were continuing at the time of this study, two have terminated in miscarriage, and three full term children have been born, two of whom are living and well.

Of twenty-nine cases of severe dysmenorrhea, relief of pain following irradiation has been noted in eighteen. Although the duration of relief is extremely variable, by repeated irradiation a satisfactory result has been maintained as long as three and a half years in one case. Evidence has not been found that repetition of treatments at intervals of three months or longer has adversely influenced ovarian function.

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DISCUSSION

Dr. T. A. GROOVER (Washington, D. C.): My interest in this subject is only comparatively recent. I have not had as large a group of cases as the essayist reported, but I believe that the results so far obtained closely parallel hers. These cases are real

problems. The psychic disturbances of amenorrhea are often distressing, quite aside from the matter of sterility. It is surprising to treat one of these patients with a small dosage as indicated by the essayist, and in six or eight weeks have her completely transformed because of the return of her menstrual cycle. I feel quite sure that the psychic effect of the treatment has nothing whatever to do with it. More than once I have seen the menstrual cycle restored while treating cancer of the breast at or about the time of the menopause. I attribute that merely to the fact that the patient has received a sufficient amount of secondary radiation to affect the ovaries in this remarkable manner.

Dr. H. A. CHAPIN (Jacksonville, Ill.): I am very glad Dr. Ford presented the paper she did at this time, because unquestionably radiation has a great field of application in pelvic conditions, and I have found many cases of thyrotoxicemia in women at the menstrual period, together with great excitement and an increase of all the symptoms, with menorrhagia. If these patients are given treatment occasionally over the ovaries, one is also helping along with the general treatment. I think there is a great field for work in the pelvic conditions. Usually these patients are extremely nervous, as are thyroid patients, and if one takes away the element of shock, one has done a great thing toward the ultimate cure.

The question has arisen as to recurrences. Surgical recurrences are common—I think, more so than in cases of radiation therapy. One other great item is that there is no operative mortality in the treatment of toxic thyroid by radiation, and when one has freed these excessively nervous individuals from the elements of worry and anxiety, one has contributed a great deal toward their quick recovery. I am inclined to believe—and have said as much to many sur-

geons—that toxic thyroid, thyrotoxicemia, the hyperactivity of the thyroid gland, constitute essentially a radiological and not a surgical case. I do not ask to take surgical

cases from the surgeon, but I think these cases of toxic thyroid are essentially radiological and should be removed from the field of the surgeon.

The Problem of the Seasonal Diseases. Bernhard de Rudder. *Strahlentherapie*, 1931, XXXIX, 223.

One of the most interesting problems, the relation between incidence of certain diseases and the seasons of the year, is discussed by the author. He believes that a number of seasonal diseases show two definite peaks of occurrence, one during the summer and one between winter and spring. They may be explained by changes in the disposition of the organism, and it is very probable that the vegetative nervous system and the inner secretory organs are involved. However, the problem is too little understood to permit of a definite explanation. Lack of ultra-violet light, influence of cold during the winter, and low vitamin content of the food have been considered as controlling factors. The seasonal curves show a definite relation to the geographic zones; there is a northern and a southern zone, and an indifferent zone in the region of the equator.

ERNST A. POHLE, M.D., Ph.D.

Promising Ways to the Cure of Hopeless Roentgen and Radium Injuries. Karl Gran-

inger. *Strahlentherapie*, 1930, XXXVIII, 775.

The author observed a patient with an old roentgen ulcer on the back; the patient later developed a cancer of the esophagus. Due to the obstruction, he lost weight very rapidly. The ulcer, which had not responded to any treatment before, almost healed within eight days. It is suggested, therefore, to consider "fasting treatment" of roentgen or radium ulcers, because encouraging results have been observed in cases of chronic ulcers located on the lower leg.

ERNST A. POHLE, M.D., Ph.D.

Some Considerations of 4,600 Radiologic Examinations in the Past Six Years. Mario Muzii. *Archivio di Radiologia*, November-December, 1930, VI, 1143.

This is a statistical and clinical review of 4,600 diagnostic and 145 therapeutic cases which the author studied at the Ospedale Civile di Teramo, and shows plates illustrating some of the more uncommon lesions encountered.

E. T. LEDDY, M.D.

CASE REPORTS

X-RAY VISUALIZATION OF A CALCIFIED GALLSTONE IN A CHILD SEVEN YEARS OLD

CASE REPORT

By HILLYER RUDISILL, JR., M.D.
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In a casual review of the American and English literature, I have found 125 cases of gallstones in children, with or without definite gall-bladder disease. The ages of the children have varied from 46 days to 15 years. This case is being reported because gall-bladder pathology in children is still not a looked-for occurrence, most of the gallstones being found during an exploratory laparotomy or at autopsy. Further, not one

of the reports showed X-ray films such as, in this case, made the pre-operative diagnosis of gall-bladder disease, with stone, possible.

H. McK., a white male, aged 7, was admitted to Dr. L. A. Montgomery's service with a complaint of almost daily attacks of abdominal pain, for a period of almost two months. The pain had no definite relationship to meals and the attacks varied from five to twenty minutes in duration. The pain was fairly well localized just to the right of the umbilicus, but there was tenderness in this region only during the attacks. The mother stated that "outside" physicians had informed her that there was frequently an elevation of temperature during or following an attack. Diagnoses made prior to



Fig. 1. Roentgenogram made after barium enema, showing a small oval area of calcium density overlying the eleventh rib on the right side.



Fig. 2. Roentgenogram made with the X-ray tube angled, projecting the calcification away from the rib.

admittance to the hospital, according to the family, had been acute appendicitis, spastic colitis, and stone in the ureter.

On admission the child was not having pain and the physical examination was negative. The admission diagnosis was colitis, probably dietary in origin. A barium enema was requested of the X-ray Department.

The fluoroscopic examination with the barium enema failed to show any pathology in the colon, but the film taken of the filled colon showed a small oval area of calcium density overlying the eleventh rib on the right side (Fig. 1). By taking further films, angling the tube, it was possible to throw this oval calcification free from the rib (Fig. 2). Lateral views failed to help localize it, as it seemed too far posterior to

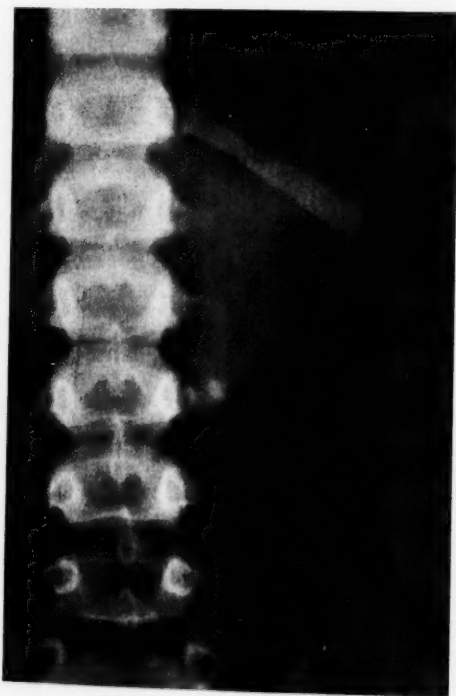


Fig. 3. A definitely diseased gall bladder was removed, containing a single calcified stone.



Fig. 4. Specimen removed at operation.

be a gallstone and too far anterior to be a kidney stone.

An intravenous pyelogram with uroselectan was done and the calcification was definitely ruled out of the right kidney. There was non-visualization of the gall bladder by oral dye, whereupon iodeikon was given intravenously. There was faint visualization of the gall bladder, the calcification being in the fundus in both the prone and lateral films (Fig. 3). The final X-ray interpretation was: Faint visualization of the gall bladder after intravenous dye (indicating gall-bladder disease), with a single calcified stone.

At operation, January 17, 1931, Dr. Montgomery removed the gall bladder. It was definitely diseased and contained a single calcified stone (Fig. 4). The appendix was also removed but did not show any pathology.

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THE X-RAY TREATMENT OF ESSENTIAL HEMATURIA

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ESSENTIAL or idiopathic hematuria, while not an uncommon condition, and not attended by any marked mortality, is nevertheless alarming to the patient, and has a marked tendency to recur.

The pathology of the condition, as shown in a case in which the kidney was removed, consisted of hemorrhagic patches in the cortex of the kidney.

The etiology of the condition is obscure. In one case it was invariably associated with some acute infection, as "a cold in the head"; in another case it began following rough harvesting operations, such as riding a "binder." Attacks nearly always recur at stated intervals, especially during periods of mental excitement or strain.

The onset is insidious, there usually being no pain or frequency, and only slight burning. The first thing noticed is the passing of blood.

The diagnosis is made by the cystoscope. Bright blood is seen in the efflux from the mouth of the ureter, on the affected side. A pyelogram is normal. Long-continued examination has ruled out tuberculosis and malignancy.

Treatment of the condition has usually been unsatisfactory.

Inspired by the marked results obtained from the X-ray treatment of uterine hemorrhage, the Bigelow Clinic decided some years ago to try out the effect of X-ray treatment on essential or idiopathic hematuria. The immediate results were so strik-

ing that the method was adopted as a routine procedure.

The results obtained are illustrated in the following four typical cases.

The first case was treated on October 27, 1927. Previously every other method of treatment had been employed in our Clinic, and at many other places, without relief. The extreme anemia did not yield to blood transfusions. Following the second series of X-ray treatment the hemorrhage ceased immediately. In April, 1928, it recurred, and stopped suddenly two hours after the first X-ray treatment had been given. On November 7, 1928, hemorrhage again returned. Three X-ray treatments were given and the bleeding promptly ceased. At this time it was decided to give three series of X-ray treatments, at intervals of a month. This was done, but before the third series was due the bleeding recurred (on July 18, 1929). Again it promptly ceased following the first treatment of the series. There was no more hemorrhage until December 18, 1929, when again two treatments were followed by prompt cessation. There has been no bleeding since.

The second patient was treated on April 4, 1928, when only one treatment was given. Bleeding stopped at once, and there has been no recurrence.

The third patient was first treated on August 14, 1928, when there was prompt arrest of bleeding. The hemorrhage recurred in a lesser degree on October 1, 1928, and again on November 8, 1928. Each time bleeding ceased promptly following X-ray treatment. Four series were then given at monthly intervals. There was slight recurrence on June 5, 1929, which again ceased following the first X-ray treatment. No hemorrhage has been reported since.

The fourth patient was treated on March 20, 1930. Two X-ray treatments were given, with the prompt arrest of bleeding following the second treatment. On April

6, 1930, hemorrhage recurred slightly and two treatments were given, with results not reported at the present date (April 22, 1930).

With the exception of the immediate relief from pain often secured through the X-ray treatment of tic douloureux, the writer has experienced nothing so impressive in the way of instantaneous response to X-ray therapy as that shown in this series. The prompt results following a first or second treatment suggest some specific type of reaction to the X-ray similar to the pain relief following its use in tic douloureux.

While it is true that other therapeutic

measures were used in this series, such as blood transfusions and irrigation of the kidney pelvis with silver nitrate solution, yet one feels that these measures do not detract from the X-ray effect in any way. These other measures failed to give relief, when previously used alone. Further, if the condition is, as one feels it is, a lesion of the blood vessels in the cortex of the kidney, pelvic lavage could not directly affect it.

The exposures used were similar to those employed in uterine hemorrhage: Focal skin distance, 10 inches; spark gap, 9 inches; 120 K.V., time, 10 minutes; milliamperage, 5; filter, 6 mm. Al and sole leather.

ADENOCARCINOMA OF THE BRONCHUS, WITH WIDESPREAD METASTASES

CASE REPORT

By W. S. MIDDLETON, M.D., Associate Professor of Medicine, E. A. POHLE, M.D., Ph.D., Professor of Radiology, and GORTON RITCHIE, M.D., Instructor in Pathology, University of Wisconsin Medical School, MADISON, WISCONSIN

Mrs. J. G. W., white female, housewife, aged 49, was admitted to the Wisconsin General Hospital on February 20, 1931, complaining of pain and swelling in the left leg. She stated that on October 29, 1930, she had sustained an injury to the fingers of her left hand and to the left lower leg in an automobile accident. A superficial laceration from scraping of the skin marked the place of injury to the left leg, which might have escaped attention had it not been for the adherence of the stocking to the abraded area by reason of exuded serum. Varicose veins had been noticed in both legs since the last pregnancy, 11 years before, and these varicosities had been more marked on the

left lower leg. The morning following the injury the left leg was quite painful, but she was able to walk. There was no swelling at this time, but the second day after the injury the patient was unable to walk by reason of the pain and swelling in the left lower leg. There were also a number of circular red spots on the left lower leg about three inches in diameter, which felt like burns and were painful to the touch. Since that time, the patient had remained in bed, experiencing irregular exacerbations and remissions of the local condition. The history by systems was interesting in two details, namely, a cough, usually non-productive since the time of injury and particularly marked when lying on the left side, and constipation. The patient had had hemorrhoids over a period of three years and there had been bleeding up to the time of admission. The past medical history was important because of the details of typhoid fever at 15 years of age and pleurisy at 19 years of age. A hemorrhoidectomy had been performed four years before and a herniotomy twenty years before. Her social history was

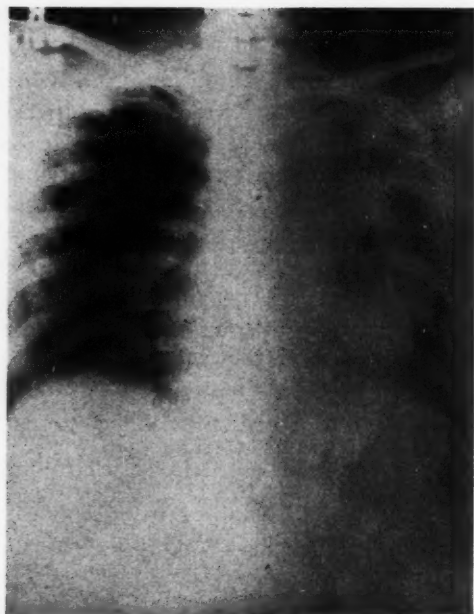


Fig. 1. Roentgenogram of the chest (February 21, 1931).

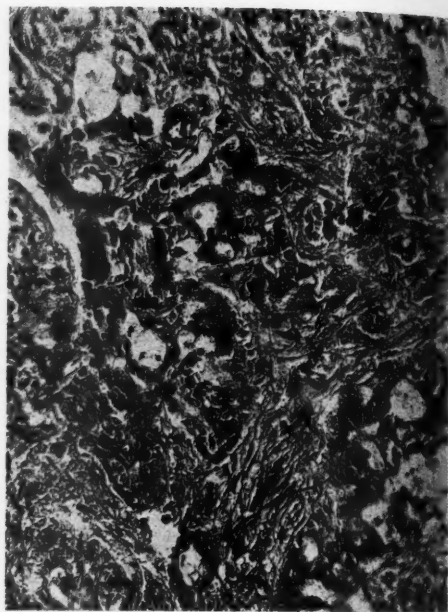


Fig. 2. Adenocarcinomatous portion of tumor Zeiss 16 mm. apochrom. oc. 8 X (170 X).

without bearing on the present conditions, as was the family history, except for the occurrence of epithelioma in the paternal grandfather.

Physical examination revealed the following pertinent findings: pigmented nevi on the right cheek and beneath the left angle of the jaw; small, firm cervical lymph nodes about the left clavicle; retraction of the left chest close to the sternum in the first and second interspaces, over which area there was decreased tactile fremitus and dullness to percussion, the area of dullness extending 5 cm. from the left border of the sternum in the first interspace, whereas posteriorly the dullness was noted off the spine of the left scapula toward the vertebral column. The breath sounds were bronchial to amphoric over the area of dullness, with marked increase in the spoken voice and definite whispering pectoriloquy. The entire remaining left chest showed a decreased

resonance, the breath sounds were somewhat suppressed, and there were abundant medium and fine moist râles throughout the left, with a few fine crepitant râles at the right base. The heart was widened in the transverse diameter, measuring 16 cm. at the maximum width. Otherwise there were no cardiac findings of importance except the increased rapidity of action. The blood pressure was 146/95 and the peripheral vessels showed some thickening. The liver, right kidney, and spleen were palpable on abdominal examination. Examination of the legs showed varicosities of the superficial and deeper veins on both sides; on the left there was some definite edema and the indurated veins in the popliteal space and over the left calf were more evident than on the right. Huge hemorrhoids were noted on rectal examination.

From the above physical findings particularly, a conclusion of malignancy of the left



Fig. 3. Squamous portion of tumor. Magnification as in Figure 2.

lung was derived, with metastases to the cervical lymph nodes. The suppression of the breath sounds with decreased air content over the left lung led to a suspicion of partial occlusion of the bronchus.

Laboratory examinations revealed the following blood count: Blood hemoglobin, 70 per cent; color index, 0.7; red blood cells, 4,950,000; white blood cells, 15,500; neutrophils, 74 per cent; small lymphocytes, 21 per cent; large lymphocytes, 4 per cent; large mononuclears, 1 per cent.

This was repeated with very little variation three days later. The urinalysis showed no abnormality of note. There were no tubercle bacilli found on the sputum examination. Blood Wassermann was negative and blood chemistry showed no deviation from normal limits. Electrocardiographic studies showed slight evidences of myocardial degeneration.

The X-ray of the chest (Fig. 1) was read

as follows: "Heart considerably widened in transverse diameter but cannot evaluate same because of position. There is a massive increase in density adjacent to heart extending upward and medially to obscure the space between the first and third ribs (anterior projection). This is, however, apparently apart from the cardiac shadow. The entire left lung field shows decreased radiolucency, rather homogeneous in nature, although some soft flocculent changes are noted through same. Dome of left diaphragm fuzzy. Sulcus shallow. Right hilum structures are increased. Some flocculent increase in density in right base. Dome of right diaphragm round and regular."

The described density on the left was interpreted as representing a primary neoplasm of the lung. Biopsy of the cervical lymph nodes showed metastatic adenocarcinoma.

The only note relative to the clinical course which is pertinent is the occurrence of a daily febrile reaction during the thirteen days of hospitalization, ranging as high as 101.2 degrees. The pulse was constantly increased on the last two days before death.

The question of X-ray deep therapy in this case was given careful consideration with the idea of prolonging the period of relative comfort of the patient. One might reasonably expect an inhibition of the growth from a conservative dose applied fractionally in order to avoid systemic reaction. This would also postpone the appearance of respiratory embarrassment, which is so hard to relieve in the end-stages of cases of this type. The patient was unable to lie on the abdomen; therefore, only the anterior chest could be exposed. She received on March 2 and 3, 1931, 140 r (surface dose) through a 10×10 square centimeter field over the involved lung area (lambda effective 0.16 Å.). Only slight nausea occurred after the treatment, but the

patient felt weak and was given no additional therapy for several days. On March 5, 1931, she was found dead in bed; she had been seen alive one-half hour before.

AUTOPSY REPORT

The body was that of a very well-nourished, middle-aged white female. Surgical incisions, each about 3 cm. long, were seen on the right cheek, at the angle of the left mandible, and in the left supraclavicular region. Skin sutures were still present. The lesions of chief interest were found in the left lung, the heart, the liver, and the adrenals. The left lung was densely adherent to the anterior chest wall over a small area in its upper lobe. The pleura showed dense fibrous thickening here. On cutting, the upper lobe was seen to be the seat of an opaque whitish neoplastic growth, which spread in all directions from, and was evidently primary in, the upper left bronchus. The artery to this area was compressed, and the part of the lobe not involved in the tumor growth was soft and hemorrhagic. The remainder of this lung and the whole of the other showed numerous widely distributed metastases, with many also on the pleural surface. The left pleural cavity contained 500 c.c. of fluid. The right lung showed an area of hemorrhagic infarction.

The bronchial and mediastinal lymph nodes were enlarged and evidently the seat of metastases.

The pericardial cavity contained about 500 c.c. of thin bloody fluid. Many warty hemorrhagic nodules were seen on the pericardial surface about the great vessels. The epicardium of the right ventricle showed an irregular area of induration of a light color and opaque appearance, roughly 5 cm. in diameter. Underlying this there was nodular neoplastic invasion of the subepicardial fat. The rest of the heart was normal ex-

cept for a few white thrombi in the right ventricle.

The liver was much enlarged, weighing 2,170 grams. It was studded with white opaque nodules, from a few millimeters to several centimeters in diameter, the largest of which were umbilicated. The cut surface of the liver was riddled with similar nodules.

The adrenals were about five times their normal size. Their shape was preserved, but each was densely infiltrated with neoplastic growth.

There were nodules also in the peritoneum, the ovaries, and the uterus.

MICROSCOPIC FINDINGS

The tumor in the lung was an adenocarcinoma (Fig. 2) derived from the bronchial epithelium, but in some areas it was a distinct squamous-cell type of cancer (Fig. 3). The growth in the epicardium, liver, adrenals, uterus, and ovaries was essentially similar to that in the lung. The complete autopsy diagnosis was as follows: Carcinoma of the left upper bronchus, with widespread metastasis; cardiac thrombosis; pulmonary thrombosis and infarction; hydrohemopericardium; acute splenic tumor; renal infarction; surgical skin wounds; multiple papillomas of skin; lineæ albicantes; obesity; chronic cholecystitis; cystic changes in ovaries; varicose retroperitoneal veins.

The first thought that occurred to us was: Did the treatment stand in any causal relation to the sudden death? This may be answered by the fact that, first, the dose administered was too small to produce injurious reactions; second, there was no excessive necrosis in the treated area except where the tumor had occluded blood vessels; third, a fresh hemorrhagic infarct was seen in the lung. We believe that in all probability the sudden exitus was occasioned by the hemorrhagic infarction of the lung.

AN OBSCURE BONE CASE

By I. S. TROSTLER, M.D., CHICAGO

The patient, A. R., was a male student, aged 19 years, of a blond, pasty-skinned, pale, clammy-handed type. The family history was negative, except that he had a brother, ten years older, with a stiff knee and stiff spinal column.

Personal History.—Usual diseases of

vaccine (consisting of *Streptococcus* 100,000,000, *Pneumococcus* 100,000,000, *Staphylococcus aureus* and *albus* 300,000,000 each, and *Colon bacillus* 200,000,000 to the cubic centimeter).

In June, 1928, he had an effusion in the right knee joint, which was aspirated and showed a thick yellowish fluid, with a few pus cells but no bacteria, either microscopically or by cultural methods. No tubercle



Fig. 1. Findings in May, 1928.

childhood; never seriously ill. Was never an "outdoor boy," nor interested in athletics of any kind, preferring to sit around the house and read. There was no history of trauma; never had had a broken bone. Tonsils had been removed in 1923.

In 1924 painful swellings appeared in the large joints (knees, shoulders, and ankles), which disappeared in a couple of weeks under local heat treatment, except in the case of the left ankle, upon which a cast was applied and worn for two months.

In May, 1928, his right wrist, right hip joint, and right knee joint became painful, and for the next two months he had a thorough course of treatment by a stock

bacilli, by animal tests. At that time his pulse was 96 to 100. Urine normal (tested four times a week for several weeks). Wassermann and Kahn tests negative. Sputum negative for tubercle bacilli. Blood showed 3,640,000 reds; hemoglobin 64; color index 0.9; 13,600 leukocytes; 65 per cent polymorphonuclears, and differential count normal. Lungs were clinically normal. No fever. He was given twenty intravenous injections of iron cacodylate, and arsenofertrate by mouth, for the anemia, with fair results, also a course of calciodoxyl benzoate by mouth, without any marked benefit.

Present Condition (October 24, 1930).—Right shoulder joint is slightly painful and

the first joint of his right middle finger is slightly enlarged. He states that all the larger joints "stiffen up" during cold and damp weather, but that he feels well during

Pleura shows no evidence of fluid, adhesions, or thickening.

Diaphragm shows diminished respiratory excursions. No evidence of herniation, eventration, or adhesions. Cardiophrenic, costophrenic, and sternophrenic angles are clear and sharp.



Fig. 2. Condition as seen in September, 1928.

the summer and particularly during dry, warm weather.

On May 16, 1928, I was asked by his physician to examine his thorax, and reported as follows:

Heart is normal in size, contour, position, and density.

Mediastinum is clear anteriorly and posteriorly.

Aorta shows no unusual bulging or pulsation. Normal.

Lungs.—Apices are both practically clear. They clear up during deep inspiration. *Parenchyma and lung fields*.—There is an area extending between the second and sixth ribs in the left side which shows some increase in density above the normal lung tissue. This increase in density is more marked in the axillary region and the least noticeable in the middle of the thorax. There is also, in the region bounded above by the second rib (above) and by the third rib below (anteriorly), an area which appears to be—and probably is—a cavity, a little larger than a large almond in size. Other portions of the lungs show little that is abnormal. *Bronchi* show a slight increase in the shadows, particularly in the denser region in the left lung (above described). *Hilar shadows* are slightly increased downward in the right side. Normal in the left side. *Glands* are seen only at bronchial bifurcations. Not unusual.

Shoulder joints are apparently normal.

Ribs and bony framework are apparently normal. Good bones.

General Summary of Roentgen Findings.—The area of increased density described, along with the increase in the bronchial shadows in the same region and the diminished respiratory excursions of the diaphragm, are rather strongly suggestive of tuberculous lung disease. If accompanied by clinical findings pointing in that direction, this should make the diagnosis *more than probable*.

On May 21, 1928, I was asked to examine the knees and wrist joints of this patient, and reported as follows:

Knees show no evidence of departure from normal, in either the bones or the soft parts around the bones or the joints.

Wrists (Fig. 1).—On the thenar aspect of the distal half inch of the *left* radius is seen a process consisting of a rarefaction, roughening, and slight proliferation. This extends to the distal surface of the radial styloid process, and into the joint of the wrist. The process is not discernible in the film made in the radio-ulnar direction, but only in the roentgenograms made in the dorso-palmar direction. On the thenar aspect of the *right* radius there are two small areas of roughening of the bone, situated within three-fourths of an inch of the distal ex-

tremity of this bone. These areas appear to be—and probably are—early lesions of the same pathologic process, in both locations, being symmetrical and of the same general appearance. Other than the two areas just mentioned, there is no roentgen evidence of any variation or departure from normal

characteristic of any disease that I have ever seen, and after having submitted photographic reductions to ten others, whom I consider to be among America's leading roentgenologists, I find none of them willing to make a diagnosis.

Other than the above described findings, there is



Fig. 3. Progress of the disease as seen in October, 1930.

in the bones, joints, or soft tissues in the regions examined.

General Summary of Roentgen Findings.—The bone lesions above described are characteristic of no disease of which I know. I am not prepared at this time to make a diagnosis.

On September 6, 1928, I was again asked to examine the wrist joints of this patient (Fig. 2) and reported as follows:

On the thenar aspect of the distal half to five-eighths inch of the right radius there is seen a process consisting of a rarefaction and slight proliferation of the bone. This extends along the thenar aspect of the bone, from the tip of the styloid process upward for about five-eighths inch, and is definitely and decidedly an extension of the same condition seen in the films made by me last May, and described to you in my communication under date of May 21, 1928.

On the thenar aspect of the distal extremity (the distal three-fourths inch) of the left radius is seen the same process as above described, but apparently more on the outside of the regular outline of the bone. This is also definitely an extension of the same process shown last May and, as above mentioned, described by me.

General Summary of Roentgen Findings.—The condition shown in the films is beyond question a progressive one, and has advanced rather than regressed during the last four months. It is not

no evidence of any departure from normal in the hands and wrists.

On October 24, 1930 (17 months after the first examination), I again examined the wrist joints of this patient (Fig. 3) and found that the process described in my previous report had proven to be definitely proliferative. At that time (the last examination), the styloid processes of both ulnae were definitely longer, sharper, and more stylus-like than normal. Other conditions in the wrist and hand showed no change. Externally and clinically, the wrist joints appeared to be normal.

As stated in my summary of roentgen findings after the examination of the wrists of this patient on September 6, 1928, ten men, who in my opinion stand out as good radiographic diagnosticians, have declined to venture a diagnosis. All are agreed that it is not syphilis, not tuberculosis, not malignancy—but what is it?

REPORT OF LONG RETAINED FOREIGN BODY OF UNUSUAL SIZE

By CHARLES D. HOLLIGER, M.S., M.D., and
FRANCIS B. SHELDON, M.D.,
STOCKTON, CALIFORNIA

The patient, Mrs. M., aged 45, was referred to us by Dr. E. S. Grigsby, of Lodi, California, with the following history. About November 19, 1930, the patient and some friends were fishing. She had caught a six-pound striped bass, and later landed one weighing eight pounds, which her husband was removing from the hook. As she started up the bank, which was moist, she slipped and fell, striking the inner condyle of her knee on the corner of a box. The knee became quite stiff and she had to have

help to get into her car. Three days later she consulted a physician. At this time a small scab was removed and about one ounce of pus evacuated. With this history, the physician thought that the wound would heal very quickly. However, it continued to drain and a drainage tube was inserted. The tube was passed downward for several inches into the soft tissues, and although he believed it to be a very deep wound for such a short infection, he continued to dress it.

On January 24, 1931, Dr. Grigsby obtained the following additional history: Near the box upon which the patient struck her knee had been a pair of scissors, which, after she fell, were picked up with the blades broken. Because of the small size of the skin wound and the small tear in the pa-



Fig. 1. Position of the foreign body, as shown in the film.

tient's clothing, it was believed that the scissors had nothing to do with the wound, but Dr. Grigsby insisted upon an X-ray examination.

On January 26th, an X-ray was taken of the patient's right knee, with the results

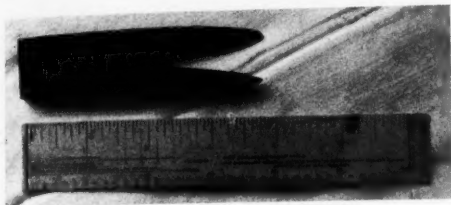


Fig. 2. Foreign body after removal, compared to a ruler to show length.

shown in the accompanying illustrations (Fig. 1). The blades of the pair of scissors are shown extending obliquely upward and

posteriorly, and lying behind the femur. The drainage tube is also shown, passing alongside the blades. In the lateral position, at the distal end, is seen a slight notch, indicating that both blades are retained in the wound. These blades were removed, and Figure 2 shows them, when compared to a ruler, to be three and three-fourths inches long.

This case is interesting in that these scissor blades entered without doing damage to the blood vessels or nerves, and also in that the patient carried such a large foreign body without seeming to realize the fact. It also shows the necessity for an X-ray examination, even in those cases in which a foreign body is not definitely suspected from the history.

We wish to express our thanks to Dr. E. S. Grigsby for the privilege of reporting this case.

CONGENITAL SYPHILIS OF BONE

CASE REPORT

By L. R. LINGEMAN, M.D., Rochester General Hospital, ROCHESTER, NEW YORK

The patient, a boy eight years of age, was admitted to the Outpatient Department of this hospital in April, 1924, because of hereditary syphilis.

The father and mother both are syphilitic. The patient had chickenpox at the age of one year, measles at three years, whooping cough at four years, scarlet fever at eight years, with no complications. At the time of admission there were no complaints and the physical examination was negative, except for a four plus Wassermann. The patient was referred to the Venereal Disease

Clinic, where intensive anti-syphilitic treatment was instituted, consisting of the administration of neosalvarsan, mercury, bismuth, and potassium iodid. The patient continued with his anti-syphilitic treatment, with occasional rest periods, until January, 1930.

In July, 1925, he was referred to the General Medical Clinic on account of pains in his arms, legs, and back, and loss of weight of three weeks' duration. At this time it was noted that the patient had the typical facies of hereditary syphilis. Physical examination showed the pupils to be unequal and irregular, but reacting to light and accommodation. Large hard glands were present at the angles of the jaws. The chest and abdomen were negative.

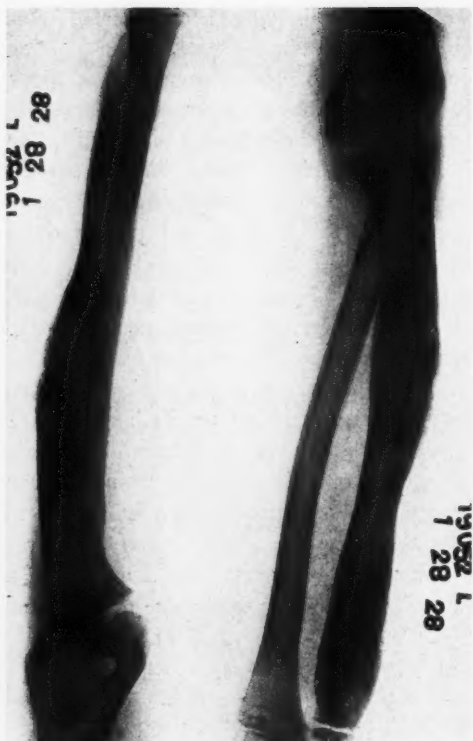


Fig. 1. Shows the condition of the ulna in January, 1928. There is a lesion involving the middle third of the shaft which has caused expansion of the shaft, with considerable periosteal new bone formation along the anterior aspect. The cortex has been partly destroyed posteriorly, and is ragged. A somewhat similar lesion is seen involving the lower end of the diaphysis.

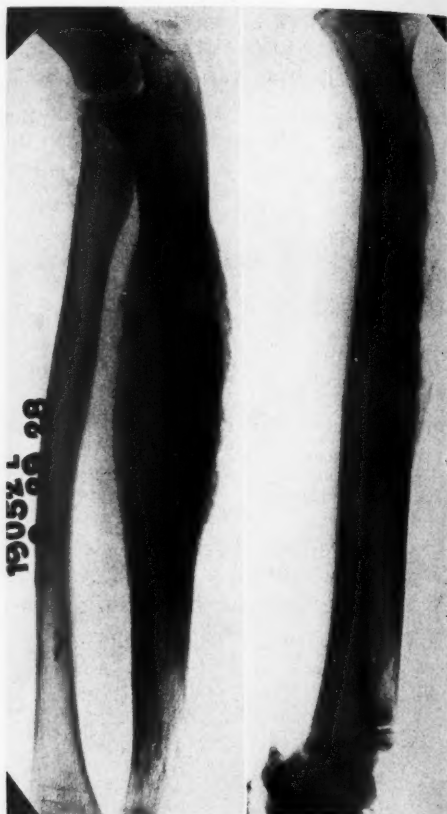


Fig. 2. Shows the condition of the ulna in July, 1928. The shaft shows more expansion and the periosteal proliferation has increased. The periosteal new bone laid down immediately adjacent to the shaft is laid down parallel to the shaft, while the remainder is laid down in the form of spicules at right angles to the shaft. However, these spicules are not as discrete nor as long as those seen in osteogenic sarcoma.

Over the upper portion of the tibiae, the lateral aspects of both ulnae in their upper thirds, and in the lumbar region about 4 cm. lateral to the spine were felt hard, tender, white, non-fluctuating masses. Muscles and joints were not painful or tender and there was no limitation of motion. X-ray examination of the ulnae and tibiae at that time showed some periosteal proliferation along the upper thirds of the shafts of these bones. The anti-syphilitic treatment was continued and the masses disappeared. However, in spite of this treat-

ment the masses in the forearms recurred and varied in size from time to time.

The patient was again seen in the Orthopedic Clinic in July, 1928, because of the swelling of the left forearm, which had become larger and tender. This did not improve under local applications, and he was admitted to the hospital in August, 1928. Films of the left forearm at this time showed definite increase in the pathology involving the upper portion of the ulna. The

EPITHELIOMA ON BRIDGE
OF NOSE

CASE REPORT

By JOHN S. DERR, M.D., F.A.C.P.
FREDERICK, MARYLAND

The patient, Mr. W. S., aged 69, by occupation a laborer, was referred for treatment May 20, 1930, by Dr. H. L. Fahrney.

History and Examination.—About a year before the examination to be reported the

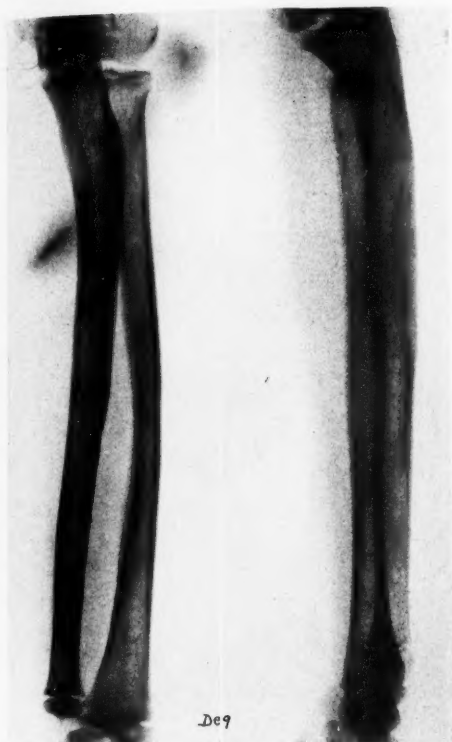


Fig. 3. Shows the ulna in December, 1929.

shaft was wider and there was more periosteal new bone formation, which, in the vicinity of the ulna, was laid down parallel with the shaft of the ulna, but in the outer zone was laid down at right-angles to the shaft. In August, 1928, the forearm was incised in the region of the swelling. The bone was found to be enlarged and ragged in appearance, and pus was found. A culture made at this time was negative. The wound closed in a short time.

Films (Fig. 3) made in December, 1929, showed complete resolution of the pathologic process. The patient still had a four plus Wassermann, but was without symptoms.

This case is of interest because it shows the development of active lesions during anti-syphilitic treatment.

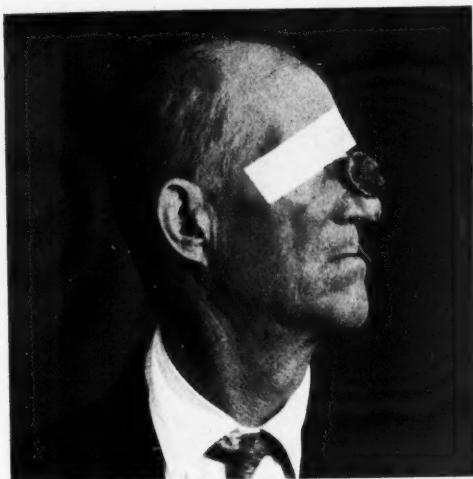


Fig. 1. Lesion before treatment.



Fig. 2. Appearance following treatment.

patient noticed a small pimple on the bridge of the nose, and picked it open. It never healed, but grew rapidly, and on the date named presented the appearance of an elevated area $3\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$ cm. in size. The surface was bloody and ulcerated and extremely tender. (See Fig. 1.)

Treatment.—It was treated by combined fulguration and low voltage X-rays. Owing to the difficulty of anesthetizing the growth, only a small amount of fulguration

could be accomplished at a time. The total number of fulgurations given was nine.

These were followed by X-ray therapy.

Technic.—Spark gap, $8\frac{1}{2}$ in.; 4 ma., no filters, 10 in. distance, time 5 minutes each treatment.

Result.—Following a period of two months during which this treatment was faithfully carried out, the growth, which had progressively healed, had completely disappeared. Practically no scar remains. (See Fig. 2.)

EDITORIAL

LEON J. MENVILLE, M.D.

Editor

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LEGAL APHORISMS

To the physician who owns and operates an X-ray machine, and to the radiologist proper, any legal phase of a case is regarded with a sort of aversion. The reasons seem to be evident. A subpoena ordering him to appear in court and testify about films he has interpreted several months previously, is time-consuming. The court room with its formalities and pointed questioning is not to his liking. Possibly the only legal interest he has is his insurance policy to protect him in case a suit is brought against him.

Until of late, only an occasional legal paper appeared on medical programs, and courses in medical jurisprudence were not taken seriously by students. The recent meetings of both roentgen-ray societies have had legal topics on their programs. State and local medical societies and their publications have also begun to exhibit more interest in legal discussions. Higher insurance rates in some localities and an increasing number of malpractice suits have brought this matter to their attention.

The legal side of X-ray practice has three main divisions, namely: (1) Liability arising out of the use of the X-ray, either for diagnostic or therapeutic purposes; (2) liability arising out of the failure to use the X-ray, and (3) the use of X-ray plates or films as evidence.

The first two have the greatest interest for the medical profession. Most of the malpractice cases fall under the head of negligence, but there are three other sources of liability which must be considered: (a) cases in which the operator guarantees no harm; (b) the fact that the X-ray is inherently dangerous, and (c) electrocution from high tension current.

Competent radiologists are available in practically every city and their equipment is such that there should be no over-exposure to X-radiation for diagnosis. The development of a fast technic, the use of intensifying screens, and the employment of properly trained technicians should obtain a sufficient number of films of diagnostic quality without injury to the patient. Well regulated laboratories will undertake to determine whether or not a patient has been subjected to a recent X-ray examination and be guided accordingly. The same holds true for those doing therapy, and, although the courts have recognized the fact that there is a possibility of an existing idiosyncrasy to X-rays, it is haphazard to undertake therapy without the fundamental knowledge of properly calculated dosage. Appliances are available for determining the output of all makes of machines and tubes. In liability arising out of the application of the X-ray as a therapeutic agency, the burden of proof lies with the plaintiff, but the defendant must meet this proof with proof sustaining his own contentions.

The presence of a burn has not generally been satisfactory evidence that negligence did exist. It seems proper to take into consideration the fact that the plaintiff was burned, together with the fact that it is possible to use the X-ray without burning

and that the burn is evidence of some negligence, even if the result of a cumulative effect, but that it is insufficient evidence in itself unless the burn was so severe that no reasonable application could have produced it. It is imperative, therefore, that all data relative to the treatment of each case be carefully recorded.

Because of the multiplying number of machines sold, and used by doctors, laymen, and practitioners of the various cults, many of whom are without training except for a short period by the salesman, who often fails to impress them with the fact that the X-ray is an inherently dangerous agent, the actual danger from the X-ray is perhaps greater to-day than it was a few years ago.

The State and Federal rule regarding physicians in general is as follows: "A physician is bound to bestow such reasonable care, skill, and diligence as physicians and surgeons in the same neighborhood, in the same general line of practice, ordinarily have and exercise in like cases," and in determining the degree of skill required it has been handed down in an opinion that "he must keep abreast of the times."

If the physician is employed by a corporation, the corporation is not liable if they have used their best judgment in employing such a physician. Many corporations throughout the country employ physicians and in some cases part of their medical duties include whatever use of the X-ray is considered necessary. Charitable and State institutions are said not to be liable to patients injured in the regular course of treatment, but this rule does not extend to other than charity patients taken care of at the same institution nor is the physician personally relieved of responsibility. Insurance companies now have a clause stating that they are not liable for suits brought about by damages after X-rays have been used for therapeutic purposes. Special rates exist for such coverage.

A decision rendered in 1910 gives the fol-

lowing ruling: "Whether it is negligent not to have used the X-ray is a question which the jury must determine with the aid of expert testimony. It is not negligent if the diagnosis could be made without it." The *Journal of the American Medical Association*, in commenting on the annual report of the Committee of Medical Defense of one of the state societies, in which report it is stated that one-half of the suits brought were based on fractures and dislocations, says: "A physician's failure to avail himself of roentgen rays in the diagnosis and treatment of what is a possible fracture or dislocation is not conclusive evidence of neglect, but a physician armed with a roentgenogram can defend himself much better than one who must rely on certain evidence."

X-ray films are still sometimes spoken of as "pictures" and for this reason it has been customary for the lawyers to relegate them to the category of ordinary commercial photographs, even though some consideration be given to their true nature and function. There is no reason for complaint about the rules for the admissibility of X-ray films which have been established, for it is clear that their truth and accuracy are sufficiently protected by the tests applied to ordinary photographs. Photographs, maps, and diagrams are competent evidence to aid the jury in better understanding the situation than it could if the condition were described by oral testimony. Their correctness is irrefutable. The same standards apply to an X-ray film, and its competency, first to be determined by the trial judge, "depends upon the science, skill, and intelligence of the party taking the picture and testifying in regard to it, and, lacking these important qualifications, it should not be admitted." The introduction of a mere negative is not sufficient, but the ability of the operator to produce or interpret it must be established. Judge Howard, in affirming a decision, said: "I do not think that the doctrine that an ordinary photograph is the

best evidence should be applied to X-ray pictures. They constitute an exception to the rule concerning ordinary documents and photographs, for the X-ray pictures are not the best evidence to the laymen of what they contain. The opinion of the expert is the best evidence." The courts have recognized the fact that roentgenology is a highly specialized art and independent of any school of healing, and the late Chief Justice Taft said, "When a case depends on a highly specialized art with respect to which the layman can have no knowledge at all, the court and jury must be dependent on expert evidence—there can be no other guide."

The question of the proprietorship of the films has been an oft-discussed one, but apparently never has been carried to the higher courts. Several quotations refer indirectly, as this one: "There was undis-

puted evidence that the X-rays taken in the hospital, as these rays were, are considered hospital property." In regard to commercial photography, the courts have held that the negatives are the property of the photographer, subject to certain restrictions as to their use, since disposition of them or prints from them and any exhibition of either invades "personal privacy." It is expressly understood that the roentgenologist acts as a consultant and that all notes, films, tracings or whatever is necessary to arrive at a definite conclusion are the property of the roentgenologist or the laboratory in which they were made, and that these findings or conclusions should be made known only to the referring physician.

S. W. DONALDSON, M.D.
Ann Arbor, Michigan.

ANNOUNCEMENTS

DR. M. J. HUBENY RESIGNS AS EDITOR OF "RADIOLOGY"

The Radiological Society of North America will regret to learn of the resignation of Dr. Maximilian J. Hubeny as Editor of RADIOLOGY. His resignation will culminate a service of years devoted to the Journal.

His indefatigable application and relentless efforts towards publishing a journal in keeping with the progress of radiology have resulted in our very splendid Journal, RADIOLOGY. To have accomplished such a result calls for talents of a rather unusual order. There can be no denying the effectiveness of his splendid work inasmuch as the character of the journal which he has produced stands as a substantial proof.

Serving in the capacity of Editor, Dr. Hubeny has always proven himself worthy of the confidence reposed in him by the

Radiological Society. The work entailed in editing a journal of the magnitude of RADIOLOGY is both arduous and complicated, and to have carried on so successfully such a stupendous undertaking is the result of the expenditure of much time and energy, directed by a persistent determination to succeed. It is a triumph of sheer grit, an attribute possessed only by men of his type.

It was with great regret that the Publication Committee and the President of the Radiological Society received Dr. Hubeny's resignation, and it was accepted only after the failure of persistent efforts to have him reconsider. We feel satisfied, however, that Dr. Hubeny will always lend his time and energy to the welfare of organized radiology, in which he has at all times been intensely interested.

The newly appointed Editor shall strive to emulate, so far as his intrinsic ability

will permit, the laudable and successful editorial qualities of Dr. Hubeny. Because of our sincere friendship and admiration for him, we shall rely to a very large extent upon his support and advice in our new field, and we know that when he is called upon he will not be found wanting.

LEON J. MENVILLE, M.D., *Editor*.

CANCER CLINICS

Dr. Joseph Colt Bloodgood, of Johns Hopkins University, Baltimore, will conduct morning and afternoon clinics, showing bone tumors and other newgrowths, at a meeting of the Radiological Section of the Wisconsin State Medical Society, Schroeder Hotel, Milwaukee, May 27, 28, and 29, 1931.

Presentation of cases will be by lantern slides and will include the following material: (1) Short clinical history (diagnosis omitted); (2) photographs; (3) radiographs; (4) photomicrographs; (5) serial radiographs of cases treated by radiation.

All radiologists are cordially invited to attend this meeting and show their interesting bone tumor cases at these clinics. Send us a list of the cases you desire to show.

FRANK W. MACKOY, M.D., *Secretary*,
Sacred Heart Sanatorium, Milwaukee.

The Editor regrets that it was impossible to publish this notice in an earlier issue, as it is his desire to give these clinics the widest possible announcement.

CORRECTION

April 4, 1931.

To the Editor:

I desire to make correction of a typographical error in my article, "An X-ray and Clinical Study of the Bones of the Hands and Feet," in RADIOLOGY, February,

1931, page 211. Under the heading "Chondromyxoma," lines from 6 to 11 read: "In 30 cases the phalanges of the hand were involved; in 7, the metatarsals; in 6, the phalanges of the feet, and in 2, the tarsals. There were no cases involving either the carpals or the metacarpals."

This should have read: "In 30 cases chiefly the phalanges and in a few the metacarpals of the hand were involved; in 7, the metatarsals; in 6, the phalanges of the feet, and in 2, the tarsals. There were no cases involving the carpal bones."

[Signed] MAX KAHN, M.D.

THIRD INTERNATIONAL CONGRESS OF RADIOLOGY, THE SORBONNE, PARIS, JULY 26-31, 1931

COMMUNICATION IV

The Third International Congress of Radiology will take place in Paris from July 26 to 31, 1931, under the High Patronage of M. le Président de la République, the Honorary Presidency of Madame Curie, and the Executive Presidency of Dr. Antoine Béchère.

All Congress meetings will take place in the amphitheatres of the Sorbonne, 47, rue des Ecoles.

Congress Committee.—*President*, Dr. Antoine Béchère; *Vice-presidents*, Prof. Regaud, Dr. Belot, Prof. Cluzet, Prof. Rechou; *General Secretary*, Dr. Ledoux-Lebard; *Secretaries*, Dr. P. Gibert, Dr. Claude Béchère; *Treasurer*, Dr. H. de Rothschild; *Adj. Treasurer*, Dr. Morel-Kahn.

CONGRESS PROGRAM

Sunday, July 26—Meeting of the delegates of the 26 countries officially represented.

Opening of the exhibition of electro-

radiological apparatus: welcome meeting, with dance.

Monday, July 27—Opening meeting of the Congress in the "Grand Amphitheatre de la Sorbonne," in the presence of M. le Président de la République: beginning of work of the Sections.

Tuesday, July 28—Question of the day to be discussed and work of Sections: evening at the Opera.

Wednesday, July 29—Question of the day to be discussed and work of Sections: visit to the exhibition of apparatus.

Thursday, July 30—Question of the day to be discussed and work of Sections: subscription banquet.

Friday, July 31—Work of Sections: general closing meeting of the Congress: night festival at the Colonial Exhibition.

QUESTIONS TO BE DISCUSSED

During the opening meeting Professor Forssell (Sweden) will speak on: "Social Struggle against Cancer."

Four questions are to be discussed at the Congress, each of which will be given out in a thirty-minute lecture at the General Meeting, all Sections present, by the following authors, designated by the radiological societies of their respective countries:

Dr. Cole (U. S. A.): "Radiological Examination of the Mucosa of the Digestive Tract."

Dr. Lynham (England): "Pre- and Post-operative Treatment of Cancer of the Breast by Radiation (Recurrency and Metastases Excepted)."

Prof. Haenisch (Germany): "Radiological Examination of the Urinary Apparatus by Excretion of Opaque Substances."

Prof. Milani (Italy): "Radiotherapy of Inflammatory Diseases."

Communications.—More than three hundred communications are announced. They

will be divided among the six following Sections:

- (1) Radiodiagnosis
- (2) Roentgen- and Curietherapy
- (3) Radio-physics
- (4) Radio-biology
- (5) Electrology
- (6) Natural and Artificial Heliotherapy

The members of the Congress will receive a volume containing the summaries of three hundred communications before the Congress.

Commission of Measures.—The Commission of Measures, where each of the twenty principal countries is represented by a physicist and a physician, will continue the work begun in Stockholm on international unification of measures.

Exhibitions.—An exhibition of books and of radiological publications is organized on the Congress premises at the Sorbonne. Communications to be addressed to Librairie Masson, 120, Boulevard Saint-Germain, Paris (7^e), France.

An exhibition of electro-radiological apparatus is also organized at La Porte de Versailles.

Entertainments.—The "Titulary and Adjoined Members" of the Congress are invited to the three following entertainments:

- (1) Welcome Meeting, with dance, on Sunday, July 26.
- (2) Opera evening on Tuesday, July 28.
- (3) Night festival at the Colonial Exhibition on Friday, July 31.

A subscription banquet will take place on Thursday, July 30.

Ladies' Committee.—A Ladies' Committee will organize excursions in and around Paris and visits to museums for "Adjoined Members" of the Congress. The Congress members will also have an opportunity to visit the Colonial Exhibition.

Lodging.—Members of the Congress will benefit by a reduction of 50 per cent on the

fare to and from the Congress, on the French railways.

After the Congress and from the 2d of August, seven different travelling parties will be organized by the Tours Office of the Congress in the principal tourist, thermal, and climatic regions of France.

- (1) Lac du Bourget, Lac d'Annecy, Chamonix - Mont Blanc, Evian (August 2-9), 1,650 francs.
- (2) Aix-les-Bains, Lac du Bourget, Route des Alpes (with autocar), Nice, Monte Carlo, Côte d'Azur (August 2-10), 1,500 francs.
- (3) Carcassonne, Route des Pyrénées (with autocar), Font Romeu, Luchon, Biarritz, Côte d'Argent (August 2-10), 1,800 francs.
- (4) Normandie, Mont St. Michel, Côte de Bretagne (with autocar), Vannes (August 2-9), 1,490 francs.
- (5) Vittel, Lakes and Passes of the Vosges, Alsace, Strasbourg (August 2-7), 1,040 francs.
- (6) Vichy, Auvergne, Puy de Dôme (August 2-6), 685 francs.
- (7) Castles of the Loire, Blois (August 3-6), 555 francs.

During these tours, members of the Congress will be received in the principal thermal and mineral watering places, and visit them.

The Tours Office of the Congress can also organize, according to the wishes of members of the Congress, any tour or stay in France after the Congress, either separately or in parties. Requests to this effect may be addressed to the Office of the Congress.

Congress Enrollment.—We beg to remind those planning to attend that "Titulary Membership" in the Congress is open only to members of radiological societies and to

persons accepted by these societies (Titulary Membership fee, 300 francs).

The wives and children of members of the Congress are admitted as "Adjoined Members" only (Adjoined Membership fee, 50 francs).

Please send all information, enrollments, or subscription fees to the office of the Third International Congress of Radiology, 122, rue La Boétie, Paris (8^e), France.

POST-GRADUATE COURSES, DELIVERED IN THE ENGLISH LANGUAGE IN THE LEADING HOSPITALS OF PARIS, FRANCE, DURING THE SUMMER OF 1931

The Faculty of Medicine of Paris (the Medical School of the University) announces that, during June and July, 1931, a comprehensive series of post-graduate courses will be presented. The enterprise is conducted under the auspices of the Association for the Development of Medical Relations (the "A.D.R.M."), a commission sponsored by the French Government.

The work will be presented in the English language. Clinics, lectures, and demonstrations will be conducted in the great hospitals of Paris, on a wide variety of topics, by the most eminent French clinicians. A nominal fee will be charged for each course. Upon the completion of each course, the student who qualifies will receive a certificate covering the work, signed by the professor in charge.

Detailed information may be secured by addressing direct, Professeur E. Hartmann, President, "A.D.R.M.," Faculty of Medicine of Paris, 12, Rue de L'Ecole de Medicine, Paris (6^e), or, in the United States, Dr. Frank Smithies, 920 North Michigan Avenue, Chicago, Illinois.

IN MEMORIAM

IN MEMORY OF MARTIN HAUDEK

Professor Martin Haudek, one of the pioneers of the young science of medical roentgenology, has departed from us. Not only we in Vienna, we in Austria, but the whole medical world mourns his loss. His name is one of the best known and most often quoted in medical science. This fame he acquired for himself and for us through his great discovery of the direct symptoms of ulcers of the gastro-intestinal tract (*Münchener Medizinische Wochenschrift*, 1910). Before this discovery this disease could be recognized only rarely, with certainty, in living subjects. Ulcers of the gastro-intestinal tract were even considered rare at that time, and their treatment was inadequate. Only as based on the results of his studies is the modern and far advanced internal roentgenotherapeutic and surgical therapy of the different stages and types of gastric and duodenal ulcers possible. They demonstrate the frequent occurrence of this disease and permit a certain diagnosis in almost every case. "Haudek's niche," the roentgenological symptom of the disease, was only the starting point for his work. In it and led by it, he developed the other roentgenologic means of ulcer-diagnosis, so full of symptoms and signs. He showed in it a thoroughness, intelligence, and exactness which are examples to us. It has perfected the roentgenological diagnosis in this field to such a degree that only rarely does it fail: 96 per cent confirmation by surgery (Haudek, 1922, at the combined meeting of the Naturforscherversammlung in Dresden). Akerlund gave the same percentage. His scientific studies, by their practical importance, spread victoriously throughout the medical world in a manner never seen before, against all the obstacles opposed so often to something new. They were not only confirmed everywhere, but



MARTIN HAUDEK

taken with enthusiasm into daily use by physicians.

Haudek's industrious mind, his studious and warm interest have borne fruit in many other fields of medicine. Besides further studies in the diagnosis and therapy of gastro-intestinal diseases and numerous publications in the whole field of roentgenological diagnosis and therapy, he has made very important observations about the course and the healing processes in tuberculosis of the lungs, which have become of great practical importance. It has been conceded that he has introduced new viewpoints in the consideration of the developmental stages and the prognosis of pulmonary tuberculosis. His statement that a series of roentgenograms of the lungs often shows in only a short time the value of the roentgenologic diagnosis, inasmuch as it shows the substratum of non-permanent sec-

ondary changes has been generally confirmed. It has been conceded, furthermore, that he helped to lay the foundation for the new teaching of the relative unimportance of the localization of tuberculosis in the apices.

Many invitations brought him, brilliant speaker and master in debate that he was, to scientific meetings in many countries, and his contributions were always great successes. Haudek enjoyed the highest esteem in his own and in foreign countries. Roentgenologic societies of many lands have made him an honorary member. He presided over the Deutsche Röntengesellschaft at one of its meetings. In many critical scientific discussions one could hear the valuable and well founded arguments of Haudek. Only a week before his death he presided over a meeting of the Wiener Röntengesellschaft and took part in the debate in a long and lively discussion. *Suaviter in modo, fortiter in re*, he has always acquitted himself with excellence and value in whatever he undertook.

To his fellow-physicians and the patients under his care he was always a reliable consultant. His remarkably happy personality made him beloved by all. Disease of the heart has taken him away suddenly. The mourning for this amiable man of science and this physician, whom the school of Vienna proudly calls their own, is widespread. I lose in him not only a faithful friend, but also a creative co-worker.

GUIDO HOLZKNECHT, M.D.,
Vienna, Austria.

*Translated by H. W. Hefke, M.D.,
Milwaukee, Wisc., U. S. A.*

THOMAS L. GRAY

Among the essayists at the Los Angeles annual meeting of the Society was to have been Thomas L. Gray, M.D., of St. Thomas, Ontario, Canada, whose death

took place after the announcement that he would present a paper on "The Value of X-rays in Diagnosis." A leader among his professional brethren, Dr. Gray had been a member of the Radiological Society of North America since 1925, and left many friends therein to mourn his passing.

WILLIAM GEORGE HETTICH

The many friends of William G. Hettich, of Chicago, were grieved to learn of his death after a rather extended illness, in Palm Springs, California, on February 27, 1931.

Mr. Hettich—or, as hundreds of his radiological friends called him, Bill—was born in Chicago, October 23, 1885, being some 46 years of age at the time of his demise. He attended the public schools of Chicago and, after being graduated from Lewis Institute, became associated with the late William Scheidel in the manufacture of X-ray and electrotherapeutic apparatus. He continued in the experimental and designing department of this pioneer firm when it merged with the Western X-ray Coil Company and became the Scheidel-Western X-ray Coil Co., where he designed and improved much of the at that time most modern X-ray apparatus and machinery. After the passing out of existence of the last-named company, "Bill" became interested in the Chicago X-ray Company, and later organized and became President of The Standard X-ray Company, which position he held until his untimely death. He was the inventor and patentee of the application of the leakage principle as applied to X-ray transformers and, because of this important contribution to the safety devices of radiology, he was awarded and received the Gold Medal of the Radiological Society of North America, at the annual meeting in Milwaukee in December, 1926.

He was a man of wide acquaintance both

within the medical profession and outside of it and had large business interests.

Throughout the duration of his illness, his case was most carefully and thoroughly watched and studied by many of America's most prominent medical and surgical men, and, in view of the progressive and fatal termination, it was difficult satisfactorily to explain the course of events, until the necropsy findings showed conclusively the character and extent of the pathology of the disease. Sufficient was found to justify the diagnosis made at the beginning of his illness.

I. S. TROSTLER, M.D., Chicago.

author attempts to submit the colon to a similar grouping. The investigations were carried out on a group of over four hundred normal students of both sexes, using the roentgenoscope and serial roentgenograms.

The observations reported and opinions expressed by the author should be of great interest to all those concerned with the roentgen examination of the alimentary tract. Those who are interested in the diagnosis of functional disorders from a roentgen examination of the gastro-intestinal tract will find much food for thought in this little book.

BOOK REVIEWS

BEHAVIOR PATTERNS OF THE ALIMENTARY TRACT. By T. WINGATE TODD, M.B., Ch.B. (Manc.), F.R.C.S. (Eng.), Western Reserve University. Pages, 77. Published by the Williams and Wilkins Co., Baltimore, for the Wayne County Medical Society, Detroit, Michigan, 1930.

This record of gastro-intestinal observation, while recognizing the value of the more purely experimental investigations and descriptive accounts of other workers, presents a point of view hitherto but little emphasized. It is the viewpoint of the behavior pattern. The author is not concerned with the precise positions or levels of significant features which act as landmarks in the alimentary tract, but has devoted his studies to the response of the digestive system to stimuli of local, reflex, or central origin. The studies cover the reaction of the stomach to very simple stimuli: water, milk, acid, alkali, and carminatives. The responses to heat and cold directly or indirectly applied, to foreign bodies, and to emotional interference have been investigated under carefully controlled conditions. In addition, the

ESSENTIALS OF MEDICAL ELECTRICITY.

By ELKIN P. CUMBERBATCH, Medical-officer-in-charge, Electrical Department, St. Bartholomew's Hospital, London, England; Examiner in Medical Electrology, University of Cambridge; former President, Section of Electrotherapeutics, Royal Society of Medicine. Pages, 443. Published by C. V. Mosby Company, St. Louis, 1929.

The sixth edition of this popular handbook of medical electricity has been entirely rewritten and many additions and alterations have been made. The chapters on the galvanic current have been rewritten and rearranged and the term "galvanotherapy" has been used to include all the therapeutic uses of this current. Since the galvanic current in the body consists of streams of navigating ions, the expression "iontophoresis" has been adopted in preference to "ionization." Galvanotherapy has been divided into three branches. In one of these the results are the consequence of the migration of the "tissue" ions, and there is no introduction of ions that are foreign to the body. In another there is, in addition, the immigration into superficial tissues of ions possessing therapeutic properties. In this

branch of galvanotherapy two forms of treatment are practised at the same time. The author believes that the ions of only a few chemical substances can exert their pharmacological properties when introduced into the superficial regions of the body. When such action is obtained the therapeutic effects are in part due to the migration of the tissue ions. When other medicinal ions are introduced the results are due wholly to the migration of the tissue ions. In the third branch of galvanotherapy, where the current is used for the destruction of tissue, the term "electrochemical cauterization" has been adopted in preference to "surgical ionization" and "electrolysis."

New chapters have been added on the sinusoidal current and the combination of acupuncture with the galvanic current. Because of the many new and important advances in diathermotherapy, the chapter dealing with this subject has been entirely rewritten. A section dealing with the surgical uses of diathermy and high frequency has been added and entitled "The Electrothermic Methods of Surgery."

Thirty-eight new illustrations have been added to the present edition and some of the original drawings have been redrawn.

jections from which the direction of exposure is evident. There is a large number of similar views both of the skeleton and of the living. On a cellophane interleaf there is printed in red a detailed sketch of each view, with a very exact explanation of the important points.

In twenty-two double plates there are illustrated the special technics for the temporal bone, the ear, the maxilla, the upper and lower jaws, and the nose.

At the end is the table of contents of the two volumes. The work is a real mine of information.

F. HAENISCH, M.D., Hamburg, Germany.

*Translated by E. T. Leddy, M.D.,
Rochester, Minn., U. S. A.*

PHYSICS OF RADIOLOGY. By J. L. WEATHERWAX, M.A., Physicist, Philadelphia General Hospital, Associate in Radiotherapeutic Physics, University of Pennsylvania Graduate School of Medicine. With a Foreword by HENRY K. PANCOAST, M.D., Professor of Roentgenology, University of Pennsylvania. Pages, 240; illustrations, 126. Published by Paul B. Hoeber, Inc., New York, 1931. Price, \$5.00.

NORMAL ANATOMY OF THE SKULL IN THE ROENTGENOGRAM. By KARL GOLDHAMMER. Part 2, with 44 photographic tables, 44 illustrative sketches, and 26 projection diagrams. (Radiologische Praktika, Vol. XIII.) Text in German, English, French, and Spanish. Published by Georg Thieme, Leipzig, 1931. Price, 120 marks.

Part 1 has been followed almost immediately by a second, identical to it in its letter press and general make-up. As in the first volume, all views are reproduced in their original size as photographic reproductions of the negative. Each view is accompanied by a little sketch made in two pro-

This book is the product of years devoted to the instruction of students in radiological physics in the Graduate School of Medicine at the University of Pennsylvania. It is very concise and covers only the essentials of the physics involved and the proper application of these principles to the treatment of patients. There is an interesting Foreword by Henry K. Pancost.

Starting with an explanation of the principles of electricity and magnetism and a discussion of the atomic theory, the physics of X-ray production and measurement are explained in an interesting and readable manner. Modern methods of determining quantity and quality of X-radiation are de-

scribed, with an especially interesting explanation of spectrometry. In the discussion of X-ray dosage, special attention is given to anatomical cross-section charts, the determination of isodose curves, and the graphic methods of recording treatments. The Kingery-Pfahler saturation method of therapy is emphasized and saturation loss curves are given for various conditions of voltage and filter.

In considering the biologic effects of roentgen rays, excerpts from Ewing's Caldwell lecture add considerably to the subject.

While the text deals mainly with roentgen-ray physics, the radium therapist will also find much of value. The author has an interesting table comparing the density of metals commonly used as filters. Failla has contributed isodose curves of a large radium pack. There are useful tables of the decay value of radon, and Widmann, Failla, and Quimby have contributed tables of erythema doses in millicurie or milligram hours for various filters and distances.

The book is a distinct contribution to the radiologic literature and should occupy a place in the library of every student on radiology, and for reference purposes will be an adjunct to the specialist in radiology.

THE NORMAL DEVELOPMENT OF THE SKELETON IN THE ROENTGENOGRAM. (Radiologische Praktika, Vol. XV.) By E. RUCKENSTEINER. Pages, 80, with 63 illustrations and 11 curves in the text, and 3 tables. Published by Georg Thieme, Leipzig, 1930. Price, 18.60 marks.

One can say with all sincerity that this new book will fill a long-felt want, for every physician who has anything to do with the interpretation of roentgenograms finds himself in frequent difficulty when asked to express judgment on the stage of development of the skeletal bones in a given case. To

ease themselves out of this difficulty some have constructed charts and tables drawn from a scattered and voluminous literature on the subject. One, therefore, has a sense of gratitude toward the author, who has taken up the task of sifting this scattered information from the literature and giving it a critical evaluation.

In the introductory chapters the development of the skeleton of the thorax is taken up in detail. There follows a survey of the bones of the skull, the teeth, the shoulder girdle, the upper extremities, the pelvis, and the lower extremities. Numberless sketches illustrate the exact and complete text.

Very much to be welcomed is the representation by means of a curve of the time of ossification of the various components of the skeleton. In three large curves the time relationships of ossification of the bones are represented by colored lines, so that a glance at the curve is all that is necessary to determine the time of appearance of each bony nucleus, and the time of its union. These curves are issued separately by the publisher, and will be found of much practical use in many a roentgen institute.

We welcome the appearance of this excellent book.

F. HAENISCH, M.D., Hamburg, Germany.
Translated by E. T. Leddy, M.D.,
Rochester, Minn., U. S. A.

THE ULCER PROBLEM IN THE LIGHT OF MODERN ROENTGENOLOGIC RESEARCH. By H. U. ALBRECHT. Pages, 79; illustrations, 116. Published by Georg Thieme, Leipzig, 1930. Price, 10 marks.

The author has at his disposal the wealth of material of the University of Frankfurt Medical Clinic, in which his Chief, Berg, has worked out his well known method of investigation of the relief of the gastrointestinal mucosa, and by means of a large

number of excellent reproductions gives a survey of the results from a roentgenologic-diagnostic and a medical-therapeutic point of view. Refinements in diagnosis are explained by a wealth of statistical material. Many interesting questions about the ulcer problem are touched upon.

F. HAENISCH, M.D., Hamburg, Germany.
Translated by E. T. Leddy, M.D.,
Rochester, Minn., U. S. A.

LE RÔLE DE LA RADIOLOGIE, DANS LE
DIAGNOSTIC DE LA TUBERCULOSE PUL-
MONAIRE. By D. V. ANGIRANY. With
Preface by Dr. DUMAREST. Pages,
75; plates, 27. Masson et Cie, Paris,
1930. Price, 20 francs.

This little book is intended to set forth the importance of roentgenologic examination of the lungs in the diagnosis of pulmonary tuberculosis and to convince physicians who still think that clinical examination is sufficient that systematic roentgenoscopy and roentgenography furnish absolute evidence of the indispensability of the method. It is written by a radiologist who first had extensive clinical experience with pulmonary tuberculosis and whose roentgenologic interpretation is strongly influenced by his daily collaboration with clinicians specializing in the diagnosis and treatment of this disease.

The theme is adequately treated. The work does not pretend to go into all phases of the subject and does not touch upon controversial questions, such as the pathways of infection.

The book is divided into three chapters, the first being devoted to the inadequacy of clinical methods of examination, the second to a description of those forms of pulmonary tuberculosis which can be brought to light only by roentgenologic examination, and the third to a discussion of indications and technic. As is so often the case with

Continental authors, the bibliography is almost entirely confined to authorities from the same country, but inasmuch as this work does not pretend to be a treatise or text-book, this failing is not so serious as it might otherwise be.

A. U. DESJARDINS, M.D.

ROENTGEN TECHNIC: A TEXTBOOK FOR
PHYSICIANS AND TECHNICAL ASSIST-
ANTS. By K. KIRSCHMANN. With
an Introduction by Dr. W. LUSTIG,
Berlin. Pages, 345; illustrations, 283.
Published by Georg Thieme, Leipzig,
1930. Price, 25 marks.

This book presents an enormous amount of material in a highly compressed form. There are chapters on physics, on electricity, and a treatise on the physics of X-rays. There follows a chapter on the production of X-rays, in which ion and electron tubes are discussed in detail, as well as a discussion of the various X-ray apparatuses. The presentation of the biologic effects of roentgen rays is followed by a description of the damages possible. A special section deals with the measurement of X-rays, the measurement of dose and of hardness, and the establishment of depth doses. A further section deals with photography, in which the chemical fundamentals, the technic of photography, the physical fundamentals, and the means of judging film quality are taken up.

The chapter on the technic of roentgen diagnosis is divided into a general and a special part. At the end there is given a table of exposure.

There follows a short exposition of X-rays in technology, and of radium therapy. Further, the instruction of nurses in roentgenologic departments is taken up; also the physical and chemical fundamental concepts, units and methods of calculation, and the periodic system are gone into thorough-

ly. Hints, prescriptions, definitions of medical terms, and seventy practice questions complete the volume.

The large number of well chosen illustrations is instructive but not all roentgenograms are equally good. The make-up is excellent.

That certain matters are omitted here and there is not to be wondered at, considering the wealth of what is offered.

F. HAENISCH, M.D., Hamburg, Germany.

*Translated by E. T. Leddy, M.D.,
Rochester, Minn., U. S. A.*

TEN YEARS OF RESEARCH IN THE BORDERLAND OF PHYSICS AND MEDICINE. Report of the Institute for the Physical Foundations of Medicine of the University of Frankfurt-am-Main. By FRIEDRICH DESSAUER. Pages, 404. with 190 illustrations and one colored tabulation. Published by Georg Thieme, Leipzig, 1931. Price, 36 marks.

In the introduction are discussed the establishment and development of the Institute for the Physical Foundation of Medicine, of which the author is the director. The body of the book, in more than 330 pages, includes in ten sections the studies made in the Institute during the last decade.

The first section, in which other workers in the Institute have collaborated, takes up the question of unipolar charged air. Experiences and results of the experiments with the ionization of air are thoroughly described. In the second section there follow investigations of the fundamental problems of the biologic effects of radiation, and a physical and theoretical explanation of the process of cell damage. In the fourth section we are made acquainted with the explanation and proof of the Gurwitsch radiation, and the application of a light analysis for the quantitative measurement of the mitogenetic rays. There follows a report

of some of the old and new studies made in the Institute of the distribution of energy in irradiated media. The sixth chapter introduces the latest developments in the chemical changes produced by electrical discharges in gases. The results of thorough investigations of the properties of cathode rays, and their practical propagation in aluminium, gas, etc., from a Lenard-Coolidge tube, are reported. There follows a section on a universal instrument for measuring radiation.

The author then gives a survey of the personalities of the earlier and present workers in the Institute, and of the papers which have been published from there. In conclusion, there follows a series of publications of friends, collaborators, and students. The book is a limitless storehouse of the results of scientific research.

The format of the book, as is the custom of the publisher, is first class.

F. HAENISCH, M.D., Hamburg, Germany.

*Translated by E. T. Leddy, M.D.,
Rochester, Minn., U. S. A.*

DEEP X-RAY THERAPY IN MALIGNANT DISEASE. A Report of an Investigation Carried out from 1924 to 1929 under the Direction of the St. Bartholomew's Hospital, Cancer Research Committee. By WALTER M. LEVITT, M.D., L.M.R.E., Medical-officer-in-charge of the Radiotherapeutic Research Department, with an Introduction by Sir THOMAS HORDER, Bart., K.C.V.O., M.D., F.R.C.P., Chairman of the Cancer Research Committee. Pages, 128. Published by John Murray, London, 1930. Price, 65 shillings.

A brief summary can hardly do justice to this report of cases of cancer treated at St. Bartholomew's Hospital by a special commission between the years 1925 and 1929. The cases, 319 in all, were referred for treatment through a member of the Re-

search Committee in charge of the appropriate group. The cases were divided into four classes: (1) breast, (2) uterus, (3) upper air passages, and (4) esophagus; later were added (5) rectum and (6) thyroid. If the carcinoma was too extensive or unsuitable for radium for other reasons, X-ray was used to treat it. Most cases had biopsies. The results of treatment were checked by an exacting follow-up. Of the 319 cases treated, 15 per cent are without evidence of tumor; definite palliation was produced in 60 per cent of the remaining cases. Tables in the text by a glance give information about the various groups, and each is followed by a short analytic comment.

This report, probably the best on the subject, is invaluable to the general practition-

er because it is simple, easy to read, and free from cumbersome technicalities and mathematics. The radiologist will find interesting the author's ideas of various treatment technics, the value of the split dose and the single dose, and his ideas of combinations of radium and X-ray. The author concludes that many newgrowths, even advanced ones, may be made to disappear by X-ray treatment, with a freedom from recurrence for four years or longer; that the risks and discomforts to the patient are slight, and that in certain cases a combination of radium and X-ray is superior to either agent alone.

The whole book is delightful to read—it is honest, free from bias, simply and clearly written. It is a shame that more books like this report are not available.

ABSTRACTS OF CURRENT LITERATURE

SUBJECT INDEX

Abdomen	972	Gastro-intestinal Tract (Diagnosis).....	995
Apparatus	973	Gastro-intestinal Tract (Therapy).....	1000
Appendix (Diagnosis)	974	Genito-urinary Tract (Diagnosis).....	1001
Arthritis	975	Gynecology and Obstetrics.....	1009
Bone (Diagnosis)	977	Heart and Vascular System (Diagnosis).....	1010
Bone (Therapy)	981	Hodgkin's Disease (Diagnosis).....	1011
Bone Diseases (Diagnosis)	983	Hodgkin's Disease (Therapy).....	1012
Bone Tumors (Therapy)	984	Light Therapy	1013
Cancer (Diagnosis)	985	Physical Therapy	1013
Cancer (Therapy)	986	Radium	1015
Chest (Diagnosis)	988	Rickets (Therapy)	1016
Chest (General)	990	Roentgenotherapy	1017
Chest (Therapy)	991	Sinuses (Diagnosis)	1022
Contrast Media	992	Skull (Diagnosis)	1024
Dental Radiography	992	Spine (Diagnosis)	1025
Diathermy	993	Thymus (Diagnosis)	1026
Experimental Studies	994	Thymus (Therapy)	1027
Gall Bladder (Normal and Pathological)	995	Thyroid (Therapy)	1028
		Tuberculosis (Diagnosis)	1029

ABDOMEN

Subphrenic Abscess. Gatewood. *Am. Jour. Med. Sci.*, September, 1930, CLXXX, 398.

The author calls attention to the failure to consider the likelihood of subphrenic abscess in any patient not doing well after an abdominal operation, even though performed months previously, and to the importance of prophylactic treatment in the early diagnosis and elimination of appendiceal and other contributory causes. He feels that a thorough X-ray examination gives the most important information upon which to base a diagnosis, and that it is a method enabling one to differentiate a subphrenic abscess from liver abscess, gumma, or from intrahepatic tumors. The presence of a fluid level below the diaphragm should always be sought for, but cannot be found in more than half of the cases.

This article contains a chart with a complete analysis of forty-one cases admitted to the Presbyterian Hospital, Chicago, and the Surgical Department of Rush Medical College.

ROE J. MAIER, M.D.

A Year's Progress in Roentgenography of Abdominal Viscera. Editorial. *Jour. Am. Med. Assn.*, Feb. 7, 1931, XCVI, 443.

The *Journal of the American Medical Association* has frequently emphasized the manner in which years of patient investigation precede each significant announcement of a medical discovery. In the year just past, Americans interested in roentgenologic diagnosis have read several such announcements.

Widest notice, perhaps, has been given to intravenous urography, the procedure by which roentgenograms of the urinary tract can be made after intravenous injection of iopax (sodium 2-oxo-5-iodo-pyridine-N-acetate, introduced as "uroselectan"). This work was begun in Germany by Lichtwitz, by Binz, and by von Lichtenberg. Working at one time with Lichtwitz and later with von Lichtenberg, Swick, an American graduate student resident

in Germany, applied the substance developed by Binz as a contrast medium in urologic diagnosis. Clinical trials were made in the United States and the results recently have been summarized in the *Journal of the American Medical Association*.

Less widely known as yet, but probably of equal importance, is an announcement by Weber. He applied, with slight modification, the method of A. W. Fischer of Frankfurt-on-Main in the diagnosis of polypoid lesions and polyposis of the colon. The old method of roentgenography after an opaque enema, although highly useful in disclosing deforming lesions of the colon, was of little service in gaining evidence of non-deforming soft masses that project into the lumen of the bowel. Fischer's method, as employed by Weber, and as employed by Gershon-Cohen in tuberculous colitis, consists first in administering an opaque enema, as in the old method. However, the patient is asked to expel this enema as completely as possible. After this has been done, what might be called an air enema is given under roentgenoscopic control. The result is that the contours of the polyps are outlined clearly in the air-filled lumen. Since the status of polyps as precancerous lesions has been conclusively demonstrated by Fitzgibbon, a method by which the presence of polyps can be detected may be a life-saving measure.

Another step forward that probably will be of wide application is the observation by Kirklin concerning papillomas of the gall bladder. Until recently he had assumed that cholecystographic distinction between papillomas of the gall bladder and stones of low calcium content was impossible. In a series of cases, however, he found that papillomas had certain definite roentgenologic characteristics: their shadows maintained the same position in all films on which they appeared; the small, round defects were never more than 1 cm. in diameter; they were never immediately at the fundal pole but often were marginal; defects might be single or there might be three or more, but always they were discrete; frequently the shadows were clear and usually they were most plainly visible at the twentieth

hour after oral administration of the opaque dye, and the shadow of the gall bladder was of excellent density. Kirklin has offered the diagnosis in about twenty cases. Although only four of the patients were operated on, the diagnosis was confirmed in each of the four.

Continental European medical literature yielded Archer and Peterson many references to roentgenologic diagnosis of ascariasis after they, independently, had correctly interpreted a film as representing this condition. They found nothing in English. Soon after ingestion of a barium sulphate cereal meal a filling defect is found in the intestine; later a string-like shadow appears, representing the barium sulphate-filled enteric canal of the parasite.

Weber believes that use of the barium sulphate enema, followed by injection of air, will increase the accuracy of diagnosis in nearly all types of colonic disease. Kirklin hopes that it may yet be possible to diagnose carcinomas of the gall bladder in their early stages. Archer and Peterson have found that roentgenologic diagnosis of ascariasis is sometimes positive when examination of the stool for ova is negative. Possibly statistics of mortality and morbidity will show the results of these discoveries and suggestions in the near future.

CHARLES G. SUTHERLAND, M.B.

Amebic Subdiaphragmatic Abscess. F. Talia. *Archivio di Radiologia*, November-December, 1930, VI, 1057.

The author reports two cases of amebic subdiaphragmatic abscess. In the first case there was radiologic, bacteriologic, and operative proof of the diagnosis; in the second, radiologic and clinical evidences were confirmed by the fact that the lesion cleared up after the administration of emetin and the aspiration of pus. He discusses the differential diagnosis from hepatic abscess, encapsulated basal pleuritis, solid and cystic tumors of the liver, etc., and shows illustrative radiographs of these conditions.

The author concludes that in the radiologic study of these abscesses one should consider primarily the diaphragmatic arch, elevation of

the dome, immobility, opacity of the costo-diaphragmatic sulcus, the margins of the diaphragm without angulation or irregularities, which are the signs usually accompanying this lesion.

E. T. LEDDY, M.D.

APPARATUS

The Standardization Apparatus of the Radiological Institute in the University of Freiburg. E. Albrecht. *Strahlentherapie*, 1930, XXXVIII, 789.

This is a brief discussion of the apparatus used at the author's laboratory for the absolute determination of the r-unit.

ERNST A. POHLE, M.D., Ph.D.

Contributions to the Biological Effects of Modern Cathode-ray Tubes. W. Schaefer and E. Witte. *Strahlentherapie*, 1930, XXXVIII, 767.

Some of the data available to-day concerning the output of cathode-ray tubes and the percentage of roentgen rays emitted by the different types of windows are discussed. Hypothetical calculations tend to show that a comparison of the biological effects of roentgen rays and cathode rays can be conducted only on the basis of equal energies effective in the tissues.

ERNST A. POHLE, M.D., Ph.D.

On the Depth Effect and the Elective Action on Tissue Produced by Short Electrical Waves. Erwin Schliephake. *Strahlentherapie*, 1930, XXXVIII, 655.

Esau constructed an apparatus for the production of short electrical waves, approximately from 5 to 20 meters long. By using a closed secondary circuit, the object can be placed in the electrical field between two condensers. A number of experiments carried out with this apparatus are described, and the clinical applicability of the short electrical waves is briefly discussed. While, for instance, ordinary diathermy applied over the chest increases the temperature in the esoph-

agus only one-half a degree centigrade, these short waves produce an increase of three degrees. In 80 cases of furunculosis, panaritium, carbuncles, and phlegmons, the author has not seen a single failure of the treatment by short electrical waves.

ERNST A. POHLE, M.D., Ph.D.

APPENDIX (DIAGNOSIS)

Roentgenology of the Appendix. Joseph W. Larimore. Surg., Gynec. and Obst., December, 1930, LI, 810.

The author believes that roentgenology of the appendix should be done only as a part of a complete general roentgenologic gastro-intestinal study. Chronic appendicitis may at times simulate duodenal ulcer and can be differentiated only by gastro-intestinal roentgenology. The normal appendix may be seen by fluoroscopic and roentgenographic study, but the normal appendix does and can empty itself very shortly after the cecum has emptied, so that non-visualization does not mean pathology. In a series of 4,049 complete gastro-intestinal studies by roentgenology, significant appendiceal findings occurred almost five times as often when the appendix was visualized, and 50 per cent of the visualized appendices had associated signs of pathology, compared with 5.3 per cent of those not visualized.

Abnormal position of the appendix may be casual or fixed, and when fixed may be of congenital or acquired origin. The acquired fixed-position is the result of inflammatory changes of the appendix, producing adhesions to adjacent structures, which may cause absolute fixation. If this fixation is to the cecum and ileum, the appendix will move at its same relative position to the cecum and ileum. The congenital, abnormal fixed-position is usually post-cecal and varies the clinical picture.

Retention of barium in the appendix after the cecum has emptied shows impaired motility of the appendix and is more significant at 24 hours, with the right colon emptied, than at 72 hours, with the cecum and right colon filled. Retained non-opaque fecal masses are revealed as vacuoles or holes in the barium shadow and are not in themselves the exciting

cause of the initial information. A pseudo-kink of the appendix may appear because of the projection of curves upon the plane picture of the film.

The position of the appendix in the abdomen has wide variations and usually extends to the left and below the ileo-cecal junction. Roentgenology has shown the inconstancy of McBurney's point, and has disproved the absolute value of that point for certain palpation. As better detail is seen on good films it is not sufficient to depend upon fluoroscopy, which, although indispensable, supplements the observation from the films. Fluoroscopy shows fixation of the appendix better, and tenderness on palpation can best be investigated by this method. The position of the appendix departs from McBurney's point in 13.5 per cent of persons. Tenderness is not present in the normal appendix. Incompetency of the ileo-cecal valve in the presence of good cecal tonus indicates pathology, usually appendicitis. Operative confirmation of these roentgenologic findings of the appendix in 358 instances has justified their use in diagnosis.

D. S. CHILDS, M.D.

Comments on the X-ray Examination of the Appendix. James T. Case. Illinois Med. Jour., March, 1931, LXI, 191.

Does chronic appendicitis exist? A census of 2,000 consecutive admissions to the Battle Creek Sanitarium showed that about 25 per cent of the patients had had an appendectomy, based on a diagnosis of chronic appendicitis, without relief of the symptoms. A few had been operated upon after one or more acute attacks, with complete relief in nearly all of the cases.

The concluding paragraph of the paper, as follows, sums it up better than any abstract one can make:

"Much information can be gained concerning the appendix through the X-ray study, especially if one employs both the opaque meal and the enema. Some of the information is of interest but hardly of practical importance toward a diagnosis of a surgical lesion. How-

ever, the location of the tip of the cecum, whether high or low, whether fixed or movable; the coincidence of a point of localized pain on pressure over the tip of the cecum; the presence of appendiceal retention, especially when persisting for several days after emptying of the cecum; the presence of concretions or foreign bodies in the appendix; the existence of partial obliteration of the proximal part of the appendix, with clubbing and distention of the distal half; demonstration of definite adhesions of a disturbing character—these are the X-ray signs of value in the diagnosis of appendiceal disease, and we believe they are well worth investigating."

CHARLES H. DEWITT, M.D.

ARTHRITIS

The So-called Endocrine Arthritis. F. Leeser and J. Simson. *Med. Klinik*, Jan. 16, 1931, XXVII, 84.

While the clinical picture of the so-called endocrine arthritis was known and described about thirty years ago, the roentgenologic manifestations of this disease have not been dealt with until a few years ago. Thirty-eight cases were examined by the authors, and they conclude that it is not possible to make a diagnosis of an endocrine arthritis from the roentgenologic examination alone. The findings are so variable that a differentiation of this form of arthritis from other forms cannot be achieved.

H. W. HEFKE, M.D.

Orthopedic Aspects of Chronic Rheumatism or Arthritis. Robert B. Osgood. *Jour. Am. Med. Assn.*, Oct. 4, 1930, XCV, 992.

Orthopedic surgeons were faced originally by the widespread deformities of the joints associated with the active disease and that persisted as fixed crippling deformities.

The author recognizes two types, atrophic and hypertrophic. In the atrophic, the earliest change is proliferation of the synovial membrane and the roentgenogram shows a very early diminution in the density of the bone ends. This is an actual loss of substance, an

early atrophy of the muscles. The disease is more common in the slender, asthenic, atrophic type of person. The age incidence is from birth to middle life.

The second type is called hypertrophic, because, although the primary change may be a fibrillation of the articular cartilage that cannot be detected in the roentgenogram, there is almost simultaneous lime salt deposit in the form of chondro-osseous spicules and ridges at the articular margins. There is no appreciable atrophy either of the bone ends or of the muscles controlling motion until very late. The disease is more common in the stocky, sthenic types who tend to an overdeposit of calcium in the tissue. Its age incidence is from middle life to death. With the co-operation of the patient and intelligent, patient effort of the physician, the skeletal structures and the relation of the viscera in both adults and children may be remodeled.

Treatment, therefore, includes improving faulty body mechanics, increasing local blood supply by heat, massage, voluntary exercise, and general physical therapy. All possible true bacterial foci should be overcome. Dietary surfeits or deficiencies should be corrected. There is evidence to suggest that the association of poor body mechanics and poor health is not incidental but is potentially important. Prevention of deformity and maintenance of joint and bone treatment of joints are discussed in general. The concept of the American Committee for the Control of Rheumatism, causing the disease commonly called chronic rheumatism or arthritis, is given in detail.

CHARLES G. SUTHERLAND, M.B.

The Production of Hypertrophic Arthritis by Interference with the Blood Supply. Arthur D. Goldhaft, Lillie M. Wright, and Ralph Pemberton. *Am. Jour. Med. Sci.*, September, 1930, CLXXX, 386.

The authors attempted to duplicate the experiment reported by Wollenberg in 1909, in which he ligated the blood supply to the patella and found that there was a definite overgrowth of bone similar to that seen in hypertrophic

arthritis. He felt, at that time, that a disturbance of circulation has a great deal to do with hypertrophic arthritis as it appears in man, and possibly also has something to do with the atrophic type.

The authors used six apparently healthy dogs of varying ages, and ligated the blood supply to the patella on one side, the other side being used as a control. In some, they even placed ligation material and tried to simulate the trauma produced on the experimental side, to eliminate this possibility as being the cause of the overgrowth of bone. In all cases there was a definite newgrowth of bone from the patella amounting to from 11 to 12 per cent in two of the dogs, and to 31, 50, and 53 per cent, respectively, in the other three.

Pathological examination of the specimens, after sacrificing the dogs, showed no evidence of acute inflammation or necrosis. The diagnosis was "Osteoid transformation of tendon, beginning myeloid activity." The overgrowth of bone began about three months after the operation and reached its height at about nine months.

Chemical analysis of the overgrowth showed the percentage of magnesium to be higher than on the control side.

The experiments proved to be in entire consonance with those by Wollenberg and would seem to indicate beyond any reasonable doubt that disturbance of the blood supply is one of the factors capable of producing arthritic change; that interference with the blood supply—probably in the nature of vasoconstriction—constitutes a large part of the underlying physiologic disturbance productive of chronic arthritis, especially the hypertrophic type as encountered in human beings.

ROE J. MAIER, M.D.

Developments in the Problem of Arthritis.
Ralph Pemberton. *Jour. Am. Med. Assn.*,
Jan. 3, 1931, XCVI, 33.

Arthritis is at last being recognized. It is taking its place as one of the great chapters of medicine, along with tuberculosis and syphilis. The reasons for this development have been pressure from the industrial world

to reduce disability pensions, the natural internal growth of the subject through the small body of workers interested in it, and an awakened appreciation of the wide premises from which the disease springs. Activity toward the problem is justified not only by the economic and human importance of it and the necessity for the further understanding of it, but also by the fact that real progress has been made in the grasp of the disease and in the methods and results of treatment. These results are available, however, only on the basis of a broad-minded approach to the problem. This approach necessitates familiarity not only with the symptoms of the disease but also with the morphologic and dynamic considerations that underlie it. For about fifteen years the medical profession has been regarding arthritis from the wrong angle. The important work of the bacteriologists has helped to illuminate the doctrine of focal infection and has brought out pathologic data and principles of great significance. The results of their further study are awaited with interest and expectation, but the arthritic problem, as a whole, is undergoing its main growth in another way and in another direction.

Arthritis is a systemic disease, the background for it often being hereditary. Certain types of persons are most frequently attacked; in short, there are prodromes that enable one to recognize susceptible individuals and often prevent the disease. Changes have been recognized in the fixed and fluid tissues of the body which point clearly to certain derangements of physiology as the cause of at least some of the symptoms. Focal infection is the result of the background rather than the cause of it. The derangement of function which physicians are now able to recognize as constituting a background of the rheumatoid problem is one that has to do, probably in several ways, with disturbance of the finer blood supply to various parts of the body. Proof of this conclusion is to be found in studies of the blood gases, studies of the rapidity with which the circulation in arthritic patients takes care of substances absorbed into it from the digestive tract, and in the study of the blood count in the blood first issuing from the capillary beds

at the periphery in the arthritic subject. This is furthermore brought out by studies of the surface temperature in the arthritic patient by means of an electric thermocouple. Arthritic persons, as a whole, have lower peripheral temperatures than do normal persons because of the decreased blood flow in the tissues concerned. Circulatory changes also account apparently for the lowered metabolic rate shown by a large proportion of afebrile arthritic patients of both types. The influence of the nervous system in producing arthritis has been recognized for generations. Sympathectomy in arthritic patients for whom such a severe procedure is justified, chiefly atrophic cases, may have striking results.

The etiologic rôle of the intestinal tract and the food intake in many cases of this disease of either type has been emphasized. Improvement of the gastro-intestinal function, cutting down the food intake, and improvement of the local and general metabolism in these sufferers have constituted a familiar and valuable therapeutic triad for the writer and his associates. Concurrently with improvement along dietetic lines the large bowel, distorted sometimes almost grotesquely, returns toward or to normal. Animal experimentation shows that this abnormal picture can be artificially produced by diets in which inadequate vitamins, a large carbohydrate intake, and curtailment of protein plays a part. It is definitely shown that on this basis infection readily implants itself in many tissues. In the presence of such an etiologic and morphologic complex, it becomes obviously inadequate to expect any one therapeutic agent to break the vicious circle. The generic nature of the etiology of arthritis and the many factors concerned in the disease require to-day a revamped outlook on it.

CHARLES G. SUTHERLAND, M.B.

BONE (DIAGNOSIS)

A Case of Eburnizing Osteitis of a Single Bone (Meloreostosis). Aldo Piergrossi. *Archivio di Radiologia*, January-February, 1931, VII, 20.

The author describes a case of eburnizing osteitis in a patient thirty years of age in whom the osseous dystrophy involved the right

lower extremity. In comparing this case with other rare bone diseases which have been reported, the author states that this lesion is characterized by hyperostosis in the form of layers along the internal or external aspect of the part or the whole member; the fact that the lesion occurs in a single bone; longitudinal extension of the osteosclerosis in the diaphysis, and rounding of the epiphysis and short bones. In the case described there were also spots of rarefaction and heterotopic ossification.

It seems likely that the development of the lesion passes through two successive phases. In the first, there is essentially a process of osteosclerosis, and the lesion may be limited to a single segment; the bone is only slightly enlarged and may be quite regular in outline. In the second phase, the areas of periostitis are predominant and enlarge and deform the bone.

The author reviews the various theories which have been reported to explain the etiology of this lesion, and supports that of Putti, attributing this osteopathy to disturbances in the sympathetic system.

E. T. LEDDY, M.D.

Osteomyelitis Variolosa: Report of Three Cases. C. F. Eikenbary and John F. Le Cocq. *Jour. Am. Med. Assn.*, Feb. 21, 1931, XCVI, 584.

The ordinary acute osteomyelitis complicating variola is not discussed. The non-suppurative, with obscure deformities and inequality in the length of the upper and lower extremities, is reviewed.

Chiari found disseminated foci in the bone marrow, with definite variolar characteristics, but no evidence of suppuration in 86 per cent of a postmortem series.

Many observers have reported deformities of the forearms and wrists having developed following smallpox. The roentgenograms indicated destruction of the lower epiphyseal lines of the radius and ulna and the upper epiphyseal lines in the radius on the right side. The left tibia and fibula showed evidences of necrotic areas in their distal portions. The right clavicle was shorter than the

left. There was no evidence nor a history of suppuration or draining sinuses, other than the necrotic areas in the tibia.

The deformities have been found only in cases in which variola has been present before the period of closure of the epiphyseal lines; adults would not develop these deformities. The effect of the virus is to produce an aseptic necrosis which chiefly affects the growing cartilage cells of the epiphyseal lines and causes premature closures.

CHARLES G. SUTHERLAND, M.B.

Lunate Osteomalacia. Edward S. Blaine. *Jour. Am. Med. Assn.*, Feb. 14, 1931, XCVI, 492.

Kienböck first described the roentgen observations in this condition; Köhler called it "secondary post-traumatic malacia." One group of observers considers the condition to be due primarily to a trauma, while another believes it to be non-traumatic in origin, with an incidental fracture occurring in some of the cases in a later stage of the disease process.

The roentgenologist's attention is directed to the condition by the roentgen finding of a faulty shadow detail of the semilunar bone in certain wrists, some with and others without injury. This abnormal appearance may be merely a fault in shape and size, or it may be a fault in bone detail, or both. In the advanced case, the normal spongy or cancellous architecture is replaced by an apparently desintegrated bone showing ill-defined margins and increased radiability—often with a quite marked osteoporosis. The onset is insidious without sudden or severe injury, and a relatively long period of development of the lesion, with tardy appearance of the symptoms.

Those who regard the condition as the result of trauma divide these cases into three groups: (1) Those due to the abnormal anatomic conditions incident to the lunate bone; (2) those due to occupational trauma in the form of repeated compression strains, and (3) those in which a single severe compression force initiates the disease. Many observers consider the characteristic changes due

to a shutting off of the blood supply to the semilunar bone, with resultant softening necrosis and disintegration. In some of the cases the roentgenogram failed to reveal a fracture which was actually present. The surgical removal of the diseased bone does not materially reduce the disability, and the lesion often results in a major degree of disability.

Four cases are reviewed by the author.

CHARLES G. SUTHERLAND, M.B.

Kienböck's Disease: Compression Osteitis of Semilunar or Lunate Bone of the Wrist: Report of Cases. N. Austin Cary and Leonard Barnard. *California and Western Med.*, January, 1931, XXXIV, 36.

The authors review the literature of reported cases and give, as the etiology for this disease, traumatism, usually due to violent dorsoflexion of the wrist. This, in all probability, injures the nutritional vessels and causes degeneration of the bone. The symptoms are: pain in the region of the lunate bone, loss of function, and, usually, more or less swelling. The X-ray findings at the time of injury are usually negative. Late in the disease there is decalcification and reduction of the space occupied by the semilunar bone.

The authors also discuss the treatment, which is operative, and give full reports of two additional cases, illustrating their article with drawings made from the X-ray films.

FRANCIS B. SHELDON, M.D.

Bone Lesions in Tardive Heredosyphilis. Eugene P. Pendergrass, Robert L. Gilman, and Kenneth B. Castleton. *Am. Jour. Roentgenol. and Rad. Ther.*, September, 1930, XXIV, 234.

The authors' main interest lies in the bone lesions of late heredosyphilis, but they have included reference to the bone lesions of prenatal syphilis in general. They have likewise made distinctions where possible between congenital and heredosyphilis except when a previous observer or reporter of cases failed to qualify his use of one or the other term. They discuss the incidence and involvement and present data of some representative cases of

tardive heredosyphilitic bone lesions in patients of twelve or over. The pathological discussion is divided into first stage, second stage, and third stage. The roentgenologic classification of tardive heredosyphilis is given: (1) Synovitis and periarticular infiltration; (2) hypertrophic and atrophic changes in the joints, with or without loose bodies; (3) diaphysitis (all bones), rarefying osteomyelitis (generalized, localized), rarefying osteitis localized (gumma), condensing osteomyelitis; (4) periostitis (all bones), Parrot's node-skull, dactylitis; (5) unusual manifestations (osteitis fibrosa cystica).

An unusual case of tardive heredosyphilis is reported. The patient had almost every possible type of bone involvement found in syphilis, all of which responded to treatment. The cutaneous manifestations and the involvement of the liver and spleen were interesting complications.

The pathologic and roentgenologic appearances in heredosyphilis are described, together with a correlation of the clinical findings.

This article is illustrated with 25 excellent roentgenograms. Emphasis is placed upon the condensing osteitis seen in the skull. The writers disagree with other investigators who believe that the bone lesions are not influenced by anti-syphilitic treatment, since they have observed a number of cases where normal trabeculation recurred.

J. E. HABBE, M.D.

Roentgenographic Studies in Normal Osseous Development. E. Kost Shelton. Jour. Am. Med. Assn., March 7, 1931, XCVI, 759.

This study was undertaken (1) to present a more practical and modern set of tabulations and roentgenograms of the normal osseous development for every year of age from birth to 20 years; (2) to present the opinions of other observers and attempt an explanation of their variations, and (3) to demonstrate further the practicability of such a standard in the differential diagnosis of the endocrinopathies.

In the author's choice of a normal subject, he has attempted to exclude all the endoge-

nous factors which may influence the osseous development from birth to 20 years. After the first year, a variation of six months above or below the accepted standard for the age is considered within the normal. All roentgenograms were considered on the day of birth. The first tabulation shows the joint to be roentgenographed and the osseous centers which are considered normally present from birth to, and including, the fifth birthday. In this way, excellent tabulations and the opinions of several observers are compared; all are given.

From a study of the phylogenesis of the endocrine system, one is led to believe that the thyroid produces a hormone of tissue differentiation rather than one of growth. The absence of one or more growth nuclei at birth is an early and recognizable sign of hypothyroidism. True mongolism, birth injuries, and other forms of mental deficiency do not consistently retard the unfolding of the osseous system, although hypothyroidism is occasionally associated with such conditions and must consequently give a confused picture. Of equal importance are the endocrinopathies that tend to further the somatic growth. Hypergenitalism is always accompanied by a rapid unfolding of the osseous system, with an early closure of the epiphyses.

Sex begins to play an important part in the latter years of the juvenile period (6 to 12 years), the female tending to be slightly in advance of the male. The rôle assumed by the anterior lobe of the hypophysis in growth and development affords excellent opportunities for roentgenologic research. Early gigantism, characterized by unusual deposition of calcium salts, together with rapid growth of the long bones, and its antithesis, hypophyseal infantilism, are more easily recognized by a comparative study. Observations are still in progress that may further modify the standards during the adolescent age.

CHARLES G. SUTHERLAND, M.B.

Maduromycotic Mycetoma (Madura Foot): Report of a Case Occurring in an American Negro. Jack W. Jones and Her-

bert S. Alden. *Jour. Am. Med. Assn.*, Jan. 24, 1931, **XCVI**, 256.

This is a report of a case occurring in an American negro. The word "mycetoma" may be taken literally to mean *fungus tumor*. In its broadest sense the term is used to describe "all growths and granulations which produce enlargements, deformities, or destruction in any portion of the tissues of man or animals, which are caused by the invasion of the infected area by fungi belonging to different genera and species, and which produce bodies of varying dimensions, color, and shape, composed of hyphæ and sometimes chlamydospores, or other types of spores embedded in the matrix." Thus this term, coined by Carter to describe the peculiar fungus foot of India, known locally as "Madura foot," has been categorically stretched to include actinomycosis as well as maduromycosis. The disease now known as "mycetoma" was undoubtedly observed by the ancient Indian surgeons, for the Sanscrit word "Vawdea" describes a disease of the foot characterized by swelling and the formation of fleshy tumors which discharge a peculiar fluid. It remained for Vandyc Carter to describe more fully the various types, and finally to establish the fungous nature of this peculiar pathologic process. There are two distinct types of mycetoma, as follows: (1) Maduromycotic mycetomas—Those forms of mycetoma with grains (granules) composed of non-segmented mycelial filaments, presenting well defined walls and usually chlamydospores or other types of spores. (2) Actinomycotic mycetomas—Those forms of mycetoma with grains (granules) composed of non-segmented mycelial filaments, in which usually the walls are not clearly defined from the contents and in which chlamydospores are absent.

Roentgenograms and the clinical appearance of the reported case seem to have forced a diagnosis of syphilis, for which the patient was treated with no results. Roentgenograms later revealed a definite productive bone change, involving the metatarsals, tarsals, and proximal phalanges of the second, third, and fourth toes. The outlines of the bone shafts were lost, having been replaced by dense, mortar-

like bone. The bone production had the appearance of having started in the medulla and grown in all directions. The right foot was amputated just below the knee and the patient had an uneventful convalescence and recovery.

CHARLES G. SUTHERLAND, M.B.

Non-traumatic Dislocations of the Atlanto-axial Joint. E. J. Berkheiser and Ferdinand Seidler. *Jour. Am. Med. Assn.*, Feb. 14, 1931, **XCVI**, 517.

With the development of the roentgen ray, cases of traumatic dislocation of this joint have been diagnosed more frequently. Several had no evidence of injury to the spinal cord, most of them being associated with fractures. Many cases of dislocation are the result of destructive diseases, as tuberculosis and syphilis. The authors report several cases which were not associated with trauma but resulted as a complication of acute infectious disease.

The anatomy of the region is reviewed. The lesions can best be demonstrated in projections of the craniocervical region, with the patient lying on the side; stereoscopic films are advantageous. The roentgenologic technic is given in detail.

In dislocations of the atlanto-axial joint, the relations are disturbed according to the degree of forward or backward limitation and according to whether it is unilateral or bilateral. In the anterior dislocation, the lateral view shows the anterior arch of the atlas relatively farther forward, with respect to the odontoid. The lateral mass of the atlas and spinous process of the axis do not converge but are divergent, so that the posterior arch of the atlas approximates the occiput more closely than normal, which shows that the atlas is tilted downward and forward on the axis. In unilateral dislocations the atlas is tilted to one side, and hence the posterior arch appears broader than normal. The shadows of the lateral masses are both visible, so that one is able to see the neural canal. Where there is an overlapping on one side only, the opposite joint space is abnormally wide.

In the antero-posterior views, the odontoid

process of the axis is not seen in its normal relation to the atlas. The absence of the joint space between the lateral facets of the atlas and axis is pathognomonic of this condition. There is either a complete overlapping or a diminution of the joint space in one or both sides, depending upon the type of dislocation.

Three types of dislocation are described, with a discussion of the mechanism of production. The etiologic factors, symptoms, and treatment are considered in detail. Five cases are reported, all in children ranging in age from 8 to 11 years. These occurred as complications from one to two weeks after acute respiratory infection. All these dislocations were reduced.

CHARLES G. SUTHERLAND, M.B.

BONE (THERAPY)

Conservatism in the Treatment of Infective Bone Lesions of the Fingers. L. H. McKim. *Canadian Med. Assn. Jour.*, November, 1930, XXIII, 642.

Only very rarely is it necessary to sacrifice a finger on account of an infective process involving the bone. Of the large number of fingers constantly being amputated, many might be saved if the significance of the radiologic findings were better understood.

Three case reports are presented, illustrating the results which can be obtained by conservative methods. The points emphasized and illustrated by the X-ray reproductions are: the early absorption of bone in the phalanges in infection following injury; the prompt arrest of the infective process under appropriate treatment; the complete recovery in a comparatively short time.

L. J. CARTER, M.D.

Slipping of the Lower Femoral Epiphysis. Joseph J. Kurlander. *Jour. Am. Med. Assn.*, Feb. 14, 1931, XCVI, 513.

Injury to the lower femoral epiphysis, especially avulsion with displacement, apparently is so rare that standard text-books make no mention of this type of injury.

The lower femoral epiphysis is not united to the shaft until the twentieth year. Because of this late union of the epiphysis to the shaft, injuries with displacement may result up to the twentieth year. It is, therefore, apparent that injuries to or diseases of the lower femoral epiphysis before the age of 20 may result in premature arrest of ossification, with a resultant shortening of the femur. It is possible that by excessive stimulation the opposite may be true. The capsule of the knee joint is attached to the femur just below the lower epiphysis and for that reason simple slipping of the epiphysis would probably not open up the knee joint. One could expect to see this type of injury when the leg has been caught in a rapidly revolving carriage or wagon wheel.

Three cases are reported, and a review of the symptoms and treatment of this condition follows. The prognosis after proper reduction is usually very good, function gradually returning to normal.

CHARLES G. SUTHERLAND, M.B.

Acute Transient Epiphysitis of the Hip Joint. O. L. Miller. *Jour. Am. Med. Assn.*, Feb. 21, 1931, XCVI, 575.

Emphasis has been given to destructive septic epiphysitis of the hip, because it is attended by profound illness and prone to be followed by permanent disability and deformity. Acute transient epiphysitis of the hip causes a child to be sick, creates temporary or permanent deformity, depending upon the management, and is of a proportionately high incidence. It is not, however, dangerous to life, nor is serious disability likely to follow its occurrence if the cause of the infection is promptly removed.

After a careful study of the roentgenograms of the neck of the femur near the epiphyseal line in the so-called acute arthritis of children, a rather constant disturbance in bone texture was seen. Acute transient epiphysitis of the hip has its highest incidence before 10 years of age. It attacks children who are vigorous and active, and there is little or no prodromal period of indisposition or

declining health. Symptoms localize rather promptly to the hip joint and there is a sharp muscle spasm, with flexion deformity and guarding of the area. Some fullness in the structures about the joint occurs, depending on the extent and virulence of infection and on the amount of exudate in the joint. Some of the children complain vaguely for a time and continue ambulatory; others are quite sick when first seen and are unable to bear weight on the affected limb.

On the first examination in some of the cases of this series, the roentgenograms were interpreted as negative. In the same cases a few days later, enough absorption had taken place along the epiphyseal line to allow a reading of destructive change in the bone texture, and sufficient exudate had accumulated to alter the joint line. With small infected infarcts lodging near the epiphyseal line, the amount of destruction resulting depends on the factors of virulence, resistance, and protection. Roentgenograms may show a localized abscess or absorption all along the metaphyseal aspect of the epiphyseal line. An abscess may develop showing lines of absorption down into the neck of the femur, and even to the trochanteric epiphysis. Sometimes the abscess forms on the epiphyseal side of the epiphyseal line and burrows through the head toward the joint. A certain amount of exudate and reaction are present, showing thickening of the overlying joint structures.

Treatment is rest in bed, traction, and removal of infectious foci. If prompt treatment is instituted, children recover without any disturbing changes in the hip joint.

CHARLES G. SUTHERLAND, M.B.

Radiographic Studies on the Healing of Experimentally Produced Fractures Followed by Administration of Irradiated Ergosterol. Jean Morelle. *Revue Belge des Sciences Médicales*, March, 1930, II, 226.

Following experimentally produced fractures of the tibia and fibula, male rats were fed strong doses of irradiated ergosterol (from 5 to 7 mg. daily—0.0001 mg. curative in rachitic rats). Films were made at periodic intervals up to the twenty-eighth day.

About the fourteenth post-operative day, increased calcium deposit was first noted at the fracture site and exuberant callus was noted on all the films, increasingly up to the twenty-first and twenty-eighth days.

In a second group, after fibular fractures, doses of from 0.1 to 4 mg. were equally effective in demonstrating rapid healing and calcium deposition at the fracture site. In both experiments the distal bony fragments always demonstrated increased calcium deposit.

CHARLES S. CAPP, M.D.

Treatment of Fractures of the Head and Neck of the Radius. J. Albert Key. *Jour. Am. Med. Assn.*, Jan. 10, 1931, XCVI, 101.

The author classifies the various fractures encountered in the head and neck of the radius, and outlines the treatment in each type. Fractures of the upper end of the radius are rarely ever the cause of limitation of flexion and extension of the forearm unless loose fragments of the radius are set free in the elbow joint. Quite the reverse is true of rotation of the forearm. Any fracture which causes the head of the radius to become ovoid or egg-shaped in contour, or which results in an irregularity in the smooth contour of the inner half of the circumference, may be expected to cause permanent limitation of rotation of the forearm, a variable amount of pain on motion, and eventually traumatic arthritis in the radio-ulnar joint and in the elbow joint proper. Any fracture of the neck of the radius which results in permanent displacement of the head of the radius, so that it remains oblique to the long axis of the shaft or more distal than normal, will give the same result.

The treatment may be (1) conservative; (2) by open operation, or (3) expectant to operation later on, if necessary. The first group includes fissure fractures of the head, chip or chisel fractures of the head of lesser extent, and fractures of the neck without displacement. The second group includes (1) comminuted fractures of the head; (2) chip or chisel fractures of greater extent, and (3) fractures of the neck, with displacement.

The treatment and technic are given in de-

tail and the third group, which should be treated expectantly, is discussed comprehensively.

CHARLES G. SUTHERLAND, M.B.

BONE DISEASES (DIAGNOSIS)

The Tabetic Arthropathies. Arthur Steindler. *Jour. Am. Med. Assn.*, Jan. 24, 1931, **XCVI**, 250.

The present paper is based on the observation of sixty-four cases of arthropathy involving ninety-nine joints. Of these, only two, or possibly three, were definitely non-tabetic. In three cases, a diagnosis of cerebrospinal syphilis was made, and it is possible that in these the arthropathy was an advance symptom of oncoming tabes.

J. K. Mitchell, in 1831, was the first to point to the connection between cord lesions and certain joint diseases. Tabes was added by Charcot in 1868, myelitis by Weir Mitchell in 1875, anterior poliomyelitis by Laborde in 1873, and, finally, syringomyelia by Sokoloff in 1892, the latter reporting twenty cases from the literature and three of his own; the oldest case reported is that of Blasius in 1848. Arthropathies are known to occur also in lesions of the cord following fracture of the spine; Chipault observed them in hematomyelia, Riedel and Westphal in peripheral nerve lesions, and they have been observed in spina bifida manifesta or occulta. From 4 to 10 per cent of tabetic patients acquire arthropathies, and 25 per cent acquire them in syringomyelia. There is a preponderance of cases in the male sex. While tabetic arthropathies are more common in the lower extremities, syringomyelia selects the upper extremities. A controversy as to the pathogenesis has long been carried on. Charcot considered the condition entirely of neurogenic origin. Trophic and circulatory disturbances arising from the degeneration in the spinal cord were responsible for the joint changes. The mechanical traumatic theory was advanced, asserting that external influences acting on a joint so predis-

posed by cord degeneration were the eliciting factors. The loss of joint sensibility produces the basis on which later, under chronic static and traumatic influences, the arthropathic joint develops. One group sees in the effect of the nerve degeneration the keynote of the pathogenesis of the arthropathic joint, while others explain the syndrome of tabetic arthropathies on the triad of analgesia, ataxia, and increased fragility, drawing a close parallel between this arthropathy and simple arthritis deformans or traumatic arthritis, and even denying the specificity of tabetic arthropathies. The experimental work and the pathology are reviewed, with a section on the microscopic pathologic changes.

With the help of roentgenology all the gross anatomic features of arthropathy can be demonstrated. The proliferative changes make their appearance in the form of parosteal callus, peri-articular and intra-articular ossification, platelets, rings, and ossification in the joint capsule. Free bodies are also observed frequently. In the hips, beginning cases show erosion of the acetabulum and irregularity of the joint line. In more advanced cases there is destruction and enlargement of the acetabulum in its posterior and upper portion, and absorption of the head and neck. In the knees, one notices a breaking down, flattening, and condensation of the sub-chondral bone in the condyles of the tibia. Pathologic displacement is also seen. Free bodies are frequently seen; parosteal callus and exostosis are common. Intramuscular and ligamentous ossifications may assume formidable degrees.

In the ankle, the most striking changes are the flattening and broadening of the astragalus, flattening of the malleoli, and the formation of parosteal callus. The relaxation of the soft parts is expressed by anterior, posterior, and lateral displacements. Chopart's joint shows comminution and jamming, parosteal callus, and free bodies. Tabetic spondylitis varies from lesser destructions of the vertebral bodies to formidable deformation with parosteal callus and ossification of the long vertebral ligaments. The roentgen findings in the shoulder are similar to those in the hip. There

is also a tendency to enormous joint effusions and many free bodies.

In the elbow, extensive destruction of the bone ends and disintegration of the joint, a great deal of parosteal callus, many free bodies, and valgus deformity are found. The treatment is outlined; as satisfactory result was considered an arrest of the destruction in the joint and such improvement in function as would result from adequate stabilization of the joint by portative apparatus.

CHARLES G. SUTHERLAND, M.B.

I.—The Roentgenographic and Pathologic Aspects of Congenital Osseous Syphilis. Stafford McLean. *Am. Jour. Dis. Child.*, January, 1931, XLI, 130.

The author's work is based on a study of roentgenograms of the bones of 102 patients with congenital syphilis, in 24 of whom gross and microscopic examination of pathologic material was made. He considers, in turn, historical data, contemporary literature, roentgenologic investigators, and the subject of periostitis. There are references to ninety-seven articles included, the earliest dating back to the year 1778. The paper treats the subject of congenital osseous syphilis in great detail and should be read in the original.

F. B. MANDEVILLE, M.D.

II.—The Correlation of the Roentgenographic and Pathologic Aspects of Congenital Osseous Syphilis, with Particular Reference to the First Months of Life. Stafford McLean. *Am. Jour. Dis. Child.*, February, 1931, XLI, 363.

This paper is a continuation of the above article. It is copiously illustrated with roentgenograms and photomicrographs of the bones in congenital osseous syphilis, and should be read in the original. Its chief purpose is to determine the value of the roentgenogram in the diagnosis of congenital syphilis and to correlate the roentgenologic picture with the underlying pathologic changes. The observations are based on the examination of more than 1,500 X-rays films of syphilitic infants, many of whom were studied serially. The subjects,

osteochondritis, "epiphyseal separation," osteomyelitis, and periostitis, are considered in great detail.

F. B. MANDEVILLE, M.D.

BONE TUMORS (THERAPY)

Cysts of the Long Bones of the Hand and Foot. Harry Platt. *British Jour. Surg.*, July, 1930, XVIII, 20.

The author analyzed and compared the clinical and radiographic pictures of a series of 20 cysts of the long bones of the hand and foot occurring in 17 patients, with those of similar cysts recorded in the literature. The bones involved in order of frequency are the phalanges (hands), metacarpals, and metatarsals. The cysts originate in the metaphysis. The favorite digit is the little finger. The majority of cysts develop insidiously, remain latent for a time, and are discovered after the occurrence of local injury. Spontaneous fracture is a fairly common phenomenon.

In 13 cysts in which microscopic examination was made of material removed at operation, two varieties of lesion were distinguished: (a) chondroma (myxochondroma) and (b) osteitis fibrosa. For practical purposes these two lesions comprise the whole morbid histology of the miniature bone cysts; alternative lesions, such as giant-cell tumors or malignant tumors, are almost unknown. The differential diagnosis between the two standard lesions is usually impossible on clinical and radiographic evidence alone. In both types of cyst spontaneous arrest of healing may occur, particularly in young patients. For such cysts no form of operative treatment is required. Cysts which are actively extending, or where bone shell is perforated by fracture, should be explored.

The author states that the most effective method of eradicating the lesion is to curette the contents and cauterize the interior of the cyst with pure carbolic acid. This procedure is best combined with the insertion of one or more autogenous bone-grafts, which hasten the obliteration of the cystic area.

J. M. MORA, M.D.

Indications for Radiotherapy in Sarcoma.
A. Lacassagne. Radiophysiologie et Radiothérapie, 1930, Vol. II, Fasc. 2, p. 247.

For the purpose of this paper, the author divides sarcomas into (1) those arising in the hemopoietic tissues and (2) those arising in supporting connective and contractile tissues. The first group is subdivided into (a) lymphosarcoma and (b) myeloid sarcoma, while the second is subdivided into (a) fibrosarcoma and (b) osteosarcoma. The lymphosarcomas are radiosensitive growths, and, because of the fact that their extent and depth from the surface usually demand a homogeneous irradiation of a large volume of tissue, X-rays are preferable to radium in the treatment of these growths. The myeloid sarcomas, in the author's opinion, should also be treated by X-rays. Local disappearance of the growth is the rule, but secondary deposits frequently appear at a later stage. In the event of failure to effect a disappearance of the growth, surgical treatment can still be carried out. The fibrosarcomas vary greatly in their radiosensitivity, but, on the whole, the author suggests that surgery should be practised wherever complete and wide removal of the growth can be carried out without serious mutilation. In other cases, however, a trial should first be made of radiotherapy. X-rays are better suited to the diffuse and deep growths, but for nodules in or near operation scars, surface radium therapy is recommended. For the osteosarcoma, X-rays should first be tried, the tumor being cross-fired from several ports of entry. In the event of failure, surgical removal should be carried out where possible.

WALTER M. LEVITT, M.B., D.M.R.E.

The Treatment of Bone Tumors. Edwin I. Bartlett. California and Western Med., December, 1930, XXXIII, 877.

The author discusses the more recent classification of bone tumors, according to origin and prognosis. He then discusses the treatment of the various groups. The benign tumors of the osteogenic group should be treated by excision without destroying the supporting action of the skeleton; the bone

cyst may be treated by stimulation with either the X-ray or surgical fracture. The giant-cell tumor is probably curable in all instances by the X-ray or radium. In the malignant group, he believes all therapeutic agents are inadequate and the type of treatment is immaterial. Among Ewing's tumors, the 11 reported in 1926, by Connor, still remain well. Practically all of them were treated differently. Among the osteogenic sarcomas there were 31 five-year cures out of 125 registered cases. All these were in the extremities and all had amputations. In looking at each case as a whole, none of the cured cases were typical of any of the known forms of osteogenic sarcoma.

The author believes the employment of amputation as a treatment of bone tumors should become relatively rare, and X-ray treatment be given a trial and looked to for a cure. This should be used until it is evident that the X-ray will not affect the growth, or until a clear diagnosis is made. He believes that the outcome of recent advances is not the saving of lives but the saving of limbs. We should allow the patient suffering from malignant bone disease to die whole under the comforting and pain-relieving effects of X-ray and morphin.

FRANCIS B. SHELDON, M.D.

CANCER (DIAGNOSIS)

Early Diagnosis and Treatment of Malignant Conditions of the Mouth and Lips. Frederick A. Figi. Minnesota Med., November, 1930, XIII, 788.

Little is to be gained by reviewing the controversy between surgeons and radiologists as to the most effective method of treating carcinoma of the mouth and lips. The type of tumor and the rapidity of its growth are most important considerations in determining the advisable treatment. At the Mayo Clinic, epitheliomas of the lip are removed surgically unless there is a definite contra-indication to operation. If the patient's age or general condition contra-indicates thorough surgical removal, the lesions are treated by irradiation

alone. In all cases in which involvement of the nodes is demonstrable at operation, subsequent intensive radiation is given. For carcinoma inside the cheek, the principles are similar to those for the lip; radium is often used as an adjunct in these cases. Epitheliomas of the jaws are better treated by surgical diathermy than by resection. Lesions of the tongue, usually epitheliomas, are treated by combinations of excision, surgical diathermy, and radium, with intensive irradiation of the regional lymph nodes, regardless of the type of treatment to the local lesion.

W. W. WATKINS, M.D.

A Contribution to the Diagnosis of Early Carcinoma of the Pylorus. H. Meyer-Borstel. Röntgenpraxis, Dec. 15, 1930, II, 1137.

It is commonly thought that carcinoma of the pylorus begins in the pre-pyloric region and not directly in the ring. The author describes two interesting cases of early pyloric carcinoma, in which the roentgen examination showed repeatedly only an elongation and slight insufficiency of the pyloric ring. The surgeon was unable to verify the diagnosis on operation, as the pylorus presented itself only as a thickened hypertrophied ring muscle. On microscopic examination of the resected specimen, the roentgenologic diagnosis was confirmed in both cases.

H. W. HEFKE, M.D.

The Diagnosis and Treatment of Carcinoma of the Breast. William Crawford White. New York St. Jour. Med., Oct. 15, 1930, XXX, 1210.

Following a description of the early warnings of tumor growth, and then the late evidences, the technic of the routine examination of the breast case is given, and then the pathologic divisions are described. In discussing the surgical treatment, the author quotes: "The efficiency of an operation is measured truer in the terms of local recurrence than of ultimate cure." He considers that all breast tumors deserve surgical treatment, except the advanced inoperable cases. In all questionable cases excise and examine a frozen section, then proceeding as indicated. He apparently

uses the cold knife, and does not advocate pre-operative radiation, chiefly on account of its practical disadvantages in delaying the operation. He advocates the post-operative radiation, to be repeated at stated intervals.

W. W. WATKINS, M.D.

Skeletal Metastases from Carcinoma of the Rectum: Report of Eight Cases. Arthur H. Aufses. Arch. Surg., December, 1930, XXI, 916.

Several writers have found skeletal metastases in approximately 10 per cent of rectal carcinoma cases. These metastases occur late in the course of the disease, but should be looked for in cases with pain. The site of the metastasis is interesting because in all the cases reported in the literature the bone involvement practically follows that originally described by von Recklinghausen in his monograph on the formation of bone metastases. The bone involvement, in the order of frequency, is as follows: vertebra, femur, ribs, skull, sternum, humerus, pelvis, sacrum, radius, scapula, and ulna.

HOWARD P. DOUB, M.D.

CANCER (THERAPY)

The Present Status of the Cancer Problem. Clarence C. Little. Ann. Surg., January, 1931, XCIII, 11.

Experimental efforts to improve methods of measuring the dosage of X-rays and radium and of applying them should be continued and increased until all sources of error which can be eliminated have been done away with. Further work with electrosurgery will also have to be done. In this connection, a very natural and sometimes desirable conservatism of the medical profession which makes it slow to accept any new technical methods may have to be combated. At least four great fields of cancer work exist in which new advances are necessary, namely, classification and differentiation of various types and degrees of cancerous growth, improvement in methods of treatment, education of the laity, and pure research concerning the causation of the condition.

F. B. MANDEVILLE, M.D.

Treatment of Cancer of the Uterine Cervix and Breast by Radium and Deep Therapy X-ray, with Seven-, Five-, and Three-year End-results. Barbara Hunt. *Maine Med. Jour.*, October, 1930, XXI, 178.

During the period from 1922 to 1930, the author treated 108 cases of cancer of the cervix with radium, or the combination of radium and the X-ray. Thirty-three patients were free from any signs of cancer, nine for seven years, six for five years, and four for three years. Of the 108 patients, only six had the lesion localized in the cervix. The author's procedure is as follows: The patient enters the hospital in the evening for observation of temperature and cleansing of the bowel. The following morning, the uterine canal is measured and a wax catheter containing silver tubes or steel needles of radium is placed in the canal. Small flat packs containing heavily filtered radium and made up to fit the individual patient are placed against the broad ligaments or other extensions. Treatments are given three times a week or ten days apart, the patient going home in the meantime. A total of from eight to nine thousand milligram-hours is given.

Cancer of the breast, either pre-operative or post-operative, is treated by the following technic: 200 K.V., 50-inch distance, and 0.5 mm. Cu and 1 mm. Al filter.

W. W. WATKINS, M.D.

Cancer of the Lip, Tongue, and Skin: A Ministry of Health Report. Janet Lane-Claypon. *British Med. Jour.*, Aug. 16, 1930, No. 3,632, p. 253.

An analysis of the literature from a statistical standpoint is reported, special reference being made to the results of treatment. In cancer of the lip, the results obtained by radiotherapy are at least as satisfactory as those obtained by operation, without its attendant disadvantages. Evidence as to the causation of cancer of the lip is almost entirely wanting, and though it seems reasonably certain that the mere act of smoking cannot be incriminated, as the percentage of smokers in cancerous and non-cancerous subjects is prac-

tically identical, it seems possible that the method of smoking, or the occurrence of burns and other injuries arising from it, may have some influence.

As regards radiotherapy in cancer of the tongue, the small number of reported cases available, lending themselves to statistical analysis, show a more favorable survival rate at three years than with surgical treatment.

Cancer of the skin has not at present been handled in the literature, in a manner, to render it suitable for statistical analysis. The results after radiotherapy appear to be more favorable with basal-cell carcinoma than with the squamous variety, although authors are not in full agreement on this point.

W. D. MACKENZIE, M.D.

The Rational Treatment of Carcinoma of the Cervix Uteri. Wendell Long. *Jour. Oklahoma St. Med. Assn.*, December, 1930, XXIII, 406.

In the treatment of cervical cancer there is still some uncertainty in the minds of many physicians as to the relative merits of surgery and radium. (This paper is written for general practitioners, to clarify this uncertainty in their minds.) A combination of radium and X-ray therapy is the most efficient form of treatment at present. Early carcinoma of the cervix may rationally be treated surgically, but if radiation is ever effective it should be in this type of case. The end-results have not proved radiation inferior to surgery. If surgery is used it is imperative that it be radical. Radiation must be in sufficient dosage, properly screened, and properly placed to introduce sufficient radiation into all parts of the area treated.

W. W. WATKINS, M.D.

Pelvic Irradiation in Cancer of the Cervix. Palmer Findley. *Nebraska St. Med. Jour.*, October, 1930, XV, 381.

The author believes it is possible to prevent the occurrence of fully one-half of the cases of cancer by timely (immediate) repair of the torn cervix and proper management of cervicitis. When cancer does occur, radium is the

remedy *par excellence*. He quotes Heyman's statistics, in which 5,024 cases of cancer of the cervix were operated upon, with 18 per cent of five-year cures, and in which 3,512 cases were treated with radium, with 16.3 per cent of five-year cures. These figures must be viewed in the light of the fact that the surgical cases were in the early stages and had 17 per cent primary mortality, while the radium cases included all stages, with no primary mortality.

W. W. WATKINS, M.D.

Radiation Therapy in Cancer of the Mouth, with Especial Reference to the Use of Pure Gamma Rays. G. E. Pfahler and J. H. Vastine. *Jour. Am. Med. Assn.*, Feb. 28, 1931, XCVI, 664.

Most cancers of the mouth can be prevented by eliminating all forms of irritation, such as tobacco, jagged or sharp edged teeth, infected gums, badly fitting plates or foreign bodies, and by eliminating syphilis.

The best time to cure cancer, even by irradiation, is in its earliest stages. Accurate and early diagnosis is a most important factor. Most cancers of the mouth evolve from some preceding, slowly developing lesion. There may be white patches or a general whiteness of the mucous membrane, which is almost transparent at the beginning, and later this may become thickened, warty, and ulcerated. This leukoplakia can be corrected by eliminating the irritant factor, using an alkaline mouth wash and, if necessary, by skillful destruction by electrocoagulation. If there is thought of cancer, a biopsy specimen should be removed for examination and the area treated locally by radium at once while waiting for the report. Malignant papilloma should be destroyed by electrocoagulation.

The authors have obtained some rather brilliant results in the past with electrocoagulation, insertion of radium needles, and combinations of them with surgery. Increasing the filtration and prolonging the application of radiation gave much superior end-results. This improved technic is based on two fundamental principles laid down by Regaud. He recommends that irradiation be prolonged so

as to destroy all of the cancer cells in the process of division. As the radiation becomes more penetrating, the diffuse necrotizing effects diminish, then practically disappear, and finally only the selective effects remain, which are manifested in the most radiosensitive cells—the cancer cells in process of division.

The filtration of rays from the radium through the equivalent of 3 or 4 mm. of lead and the prolongation of the effect during three or four weeks' time, combines the principles of the "saturation method" by keeping the radiation effects up to the limit of normal tissue tolerance for a considerable time. The general technic is given in detail and the end-results are comprehensively reviewed. The advantages and disadvantages of pure gamma radiation treatment are given, and the associated treatment is outlined.

CHARLES G. SUTHERLAND, M.B.

Cancerous Moles. Sidney J. Wilson. *Texas. St. Jour. Med.*, December, 1930, XXVI, 584.

It is universally agreed that the melanotic mole, with one exception, is the most malignant of cutaneous sarcomas and, once the blood or lymph channels are invaded, all known forms of treatment are useless. Radical measures are to be used in treating a lesion of this type, and a definite diagnosis not attempted by biopsy. Complete destruction is what is desired and this may be accomplished by excision, cauterization, X-ray or radium irradiation.

W. W. WATKINS, M.D.

CHEST (DIAGNOSIS)

Pork Bone in Bronchus Causing Symptoms Simulating Pulmonary Tuberculosis. Charles D. Sneller. *Laryngoscope*, February, 1931, XLI, 117.

This is a case report of a female, aged 43. Five months before admission to the hospital, she choked while swallowing some meat. For almost two weeks she expectorated blood-streaked sputum. This gradually became thicker and free from blood. There was some weakness, loss of weight, and low-grade after-

noon temperature. The only symptom was a burning sensation in the chest, more in the right than the left side. The X-ray examination revealed an increased density in the right infrahilum region, with moderate consolidation of the adjacent lung (called obstructive atelectasis). The fluoroscopy showed a lagging of the right leaf of the diaphragm. A diagnosis of a non-opaque foreign body in the right lower bronchus was made, and a bronchoscopy without anesthesia was done. A piece of pork bone, $2 \times 8 \times 15$ mm., was removed. The patient made a rapid and uneventful recovery.

The author concludes as follows:

"At the present time the careful study of roentgenograms in the presence of radio-translucent (non-opaque) foreign bodies is our best aid in diagnosis."

HILLYER RUDISILL, JR., M.D.

The Chest in Rachitic Children: A Roentgenologic Study. Ralph S. Bromer. *Jour. Am. Med. Assn.*, Feb. 14, 1931, **XCVI**, 509.

Seventy-eight patients showing signs of rickets, such as a rosary or deformity of the chest, were studied for information on the incidence of pneumonia and atelectasis, the type of pneumonia usually encountered, the prognosis, and the differential diagnosis of pneumonia and atelectasis. An effort was made to study the usual roentgenographic distribution of atelectasis and to reach some conclusion that would be an aid in the differential diagnosis. These patients were divided into three groups: (1) Thirty-one showed a rosary in the roentgenogram, but exhibited at no time any evidence of chest deformity or pneumonia; (2) 24 showed a rosary in the roentgenogram and presented roentgenographic and clinical evidence of pneumonia, but with little or no chest deformity; (3) 23 showed marked chest deformity, with or without pneumonia.

The earliest changes in the roentgenogram are the beading of the ribs or the rosary, shown by the saucer-shaped margins of the sternal extremities. In seven cases, before healing had begun, the ribs had a moth-eaten, streaked appearance, the cortex was rarefied, and cast only a faint shadow in the roentgenogram.

In Group 1, three showed indistinct strip-like shadows of increased density, running upward and downward from each hilum. Semi-obvious deformity of the chest was not present, and these shadows could not be regarded with certainty as the usual manifestations of atelectasis.

None of the cases of Group 2 showed changes that could be regarded as characteristic of the atelectasis due to rickets. In the third group, the ribs were thin and often had the streaked and rarefied appearance indicating weakness of the chest wall. Parallel with the sternum, usually running from the second and third vertebræ, were strip-like shadows of increased density in each lung, which were caused by atelectasis. Scattered throughout the lungs beyond the atelectatic strips were small, more or less circumscribed areas of increased density which were due to small areas of atelectasis or bronchopneumonia. Many of the cases of bronchopneumonia showed large dense areas, due to influence of numerous lobular areas of involvement.

The usual roentgen signs of atelectasis cannot be relied upon in cases of rachitic deformity.

CHARLES G. SUTHERLAND, M.B.

The Limits between the Normal and Pathologic in the Lung Roentgenogram. Nonnenbruch. *Röntgenpraxis*, Jan. 1, 1931, **III**, 3.

A roentgenologic examination is essential for the diagnosis of diseases of the lungs. Borderline cases between the normal and pathologic are frequently encountered, and the clinician and the roentgenologist must come to conclusions with combined efforts. A high position of the diaphragm is often difficult to explain, as this may be caused by pleurisy, paralysis of the phrenic nerve, or subdiaphragmatic processes. The diagnosis of the "primary effect," as the first invasion of tuberculosis is called, is only rarely possible by means of a roentgenogram, and is demonstrable only after calcification has taken place. Involvement of the hilum glands by tuberculosis may occasionally be demonstrated; sometimes it is impossible to differentiate it from

other diseases. Some years ago, apical tuberculosis was diagnosed very frequently, when the roentgenologic examination showed cloudiness or increased density. The clinician today hesitates to make this diagnosis. In about 90 per cent of all chest films, one may demonstrate such changes which correspond anatomically to a thickened pleura or healed foci in the apices.

Since Assmann published his findings of isolated tuberculous foci in the subclavicular region, one has learned that this form of tuberculosis is often the incipient stage of an active process. In the diagnosis of a miliary tuberculosis of the lungs one must rely on the roentgenologic examination more than on the clinical findings. A number of cases of healed miliary tuberculosis, representing itself by multiple and small areas of calcification throughout the lungs, have been described, which were not suspected clinically. The increased bronchial markings, extending from the hilum into the apices, are of no value for the diagnosis of an active tuberculosis.

H. W. HEFKE, M.D.

CHEST (GENERAL)

Spontaneous Pneumothorax. J. P. Palmer and Robert B. Taft. *Jour. Am. Med. Assn.*, Feb. 28, 1931, **XCVI**, 653.

"Spontaneous pneumothorax" is a term generally used to indicate the presence of air in the pleural cavity from any internal cause. Some consider as spontaneous only those cases in which there is no associated pathologic change in the lung (the so-called idiopathic pneumothorax). The authors consider those occurring from any internal cause.

Taken as a whole, the condition is not uncommon. Idiopathic pneumothorax is rare. The authors report six cases; in five, no pathologic change of the lung was demonstrable nor any history of previous lung trouble elicited and the subsequent histories showed them to be normal in health. In the sixth, subsequent examination was not made. The most common etiologic factor is tuberculosis. There are more cases in children due to acute infectious disease. Among the other underlying

causes are empyema, gangrene, bronchiectasis, infarct, pneumonia, emphysema, new-growths, and, very rarely, the action of gas-forming bacteria in a pleural exudate.

No cause is known for the idiopathic group. Theoretical etiologic factors are tuberculous infarction, rupture of an emphysematous bleb in the margin of the lung, and rupture of an adhesion by unusual exertion. Because this type rarely ends fatally it is difficult to establish the real cause.

The roentgen examination should be both fluoroscopic and roentgenographic. The upright position is most satisfactory. Six cases are reviewed and the treatment is outlined. The most unusual feature is the fact that there were two cases in which there was a massive hemorrhage into the pleural cavity.

CHARLES G. SUTHERLAND, M.B.

Roentgenological Study of the Superior and Posterior Mediastinum. Samuel Brown and Harold G. Reinecke. *Am. Jour. Surg.*, December, 1930, **X**, 452.

The authors make a plea for the examination of the superior and posterior mediastinum in both the antero-posterior and lateral views. They show the advantages of these positions by a number of illustrations depicting the various lesions of this region, and the changes which these lesions produce on the normal structures of the mediastinum. The trachea is often displaced from its normal course, and its contour may also be altered. In lesions of the esophagus, the lateral view is of particular advantage. In aneurysms, also, the location of the aneurysm can be determined, particularly its relation to the trachea. The origin of many abnormal shadows encroaching upon the mediastinum can also be determined from the lateral view.

HOWARD P. DOUB, M.D.

Changes in the Lungs Following Roentgen Exposure. M. Lüdin and A. Werthemann. *Strahlentherapie*, 1930, **XXXVIII**, 684.

Changes in the lung following intense X-ray therapy over the chest have been described by

a number of clinicians. This induced the author to study experimentally the effect of repeated roentgen doses on the lungs of rabbits. The technic is as follows: 160 K.V., 23 cm. F.S.D., 8 mm. Al, 2.3 ma., 0.55 mm. H.V.L. in Cu, 500 r per field. Each week either the anterior or posterior chest was treated until the animals died. In the first series, the field of exposure was 5×5 sq. cm., and in the second series 12×12 sq. cm. In the first series, the changes were not uniform; the rabbits died up to 131 days following the first exposure. In the second series, the average life amounted to 97.5 days; the pathological changes were very marked. They consisted essentially of bronchopneumonia, with exudative bronchitis. The epithelium of the alveoli was destroyed after having undergone all stages of degeneration. There was also marked edema of the lungs, with extensive proliferative processes in the epithelium of the bronchi. In some instances, these resembled the histological picture found in carcinoma, because of the abundance of atypical mitosis and the pyknosis of nuclei.

ERNST A. POHLE, M.D., Ph.D.

The Diaphragm: A Clinical and Roentgenologic Study. R. Pomeranz. *Jour. Med. Soc. New Jersey*, September, 1930, XXVII, 734.

The position of the diaphragm depends upon three factors: intra-abdominal pressure, intrathoracic pressure and the retraction power of the lungs, and tone of muscle. Every pathologic position of the diaphragm can be explained by consideration of these three factors. The fluoroscopic examination should, as a rule, begin with the dorso-ventral direction, proceeding in several oblique directions, and ending in the fronto-lateral direction. The physical examination will bring forth certain evidence, but one glance under the fluoroscope will give us more information about the position and function of the diaphragm than all other physical signs. Among the pathologic conditions to be borne in mind are partial or complete absence of the left diaphragm; abnormal high position, as in pregnancy, ascites, meteorism, and obesity; low

position, as in emphysema, asthma, and enteroptosis; high position on the right, as in subphrenic abscess; tumor or diaphragmatic pleurisy, or gas under the diaphragm in ruptured viscus.

W. W. WATKINS, M.D.

CHEST (THERAPY)

Treatment of Non-tuberculous Suppurative Pneumonitis, Abscess, and Bronchiectasis. John Alexander and William W. Buckingham. *Jour. Am. Med. Assn.*, Nov. 15, 1930, XCV, 1478.

The term "suppurative pneumonitis" has been widely adopted to include the various non-tuberculous, cavernous and non-cavernous, pulmonary lesions and their combinations in the same patient. Until recently, relatively speaking, accurate diagnosis of the exact character of the lesions of suppurative pneumonitis and the factors that determine their onset and progression or regression, have been little understood, and effective treatment has often been a matter of chance. Iodized oil pneumograms and bronchoscopy, together with a better appreciation of the etiologic factors and value of the patient's history, are largely responsible for increasing accuracy of diagnosis and for the development of therapeutic measures. There is an early stage of suppurative pneumonitis when medical treatment is best, and often cures. If it fails to produce improvement, the patient enters a stage of the disease when surgery may offer incomparably the best chance of cure. The lesions of the earliest stages of suppurative pneumonitis are usually a purulent infiltration of the alveoli and interstitial tissue of the lung, with an associated infection of the bronchioles and small bronchi. Chief among the causes are: (1) aspiration of infected material, commonly from infected mouths or sinuses; (2) aspiration of any type of foreign body; (3) prolonged bronchial obstruction by intra- or extra-bronchial neoplasms, aneurysms, strictures, foreign bodies, or mucous plugs; (4) incomplete resolution of pneumonia; (5) bacteremia may be responsible for emboli that establish pulmonary infarcts, or sterile infarcts may become in-

fect; (6) pulmonary infection, occasionally occurring from extension through lymphatics from neighboring foci, and (7) wounds of the lung, especially when a foreign body remains.

The most useful medical and surgical methods of treatment are: sanatorium regimen; frequent postural drainage; elimination of mouth and sinus infection; neo-arsphenamin intravenously; bronchoscopic removal of foreign bodies and secretions; artificial pneumothorax; phrenicotomy; extra-pleural pneumolysis; extra-pleural thoracoplasty; drainage of an abscess; lobectomy.

CHARLES G. SUTHERLAND, M.B.

Hypertrophic Pneumic Osteoarthropathy (Pierre Marie). Carl Blumensaat. Röntgenpraxis, Feb. 1, 1931, III, 134.

The chronic inflammatory diseases of the lung and pleura and diseases of the heart are most frequently responsible for the lesion called hypertrophic pneumic osteoarthropathy. Only rarely may a lung tumor, primary or metastatic, lead to this picture. The author describes this occurrence in a case with a large metastatic melanoblastoma in the lung and multiple skin metastases. After roentgen therapy the metastatic growth in the right lung disappeared entirely, and it was noted also that the periosteal changes improved, especially in the hands and feet.

H. W. HEFKE, M.D.

CONTRAST MEDIA

Pharmacology of Brominated Oils. Clayton S. Smith and Helen L. Wikoff. Jour. Lab. and Clin. Med., October, 1930, XVI, 43.

Intratracheal and intraperitoneal injections of brominated esters of the fatty acids from cottonseed oil were eliminated from the site of injection in rabbits within a week. Repeated doses of the brominated esters produced no deleterious effects.

A. O. HAMPTON, M.D.

Campidol (Iodized Rapeseed Oil): Its Use in the Roentgenographic Visualization of the Body Cavities. Mark A. Glaser.

Am. Jour. Roentgenol. and Rad. Ther., November, 1930, XXIV, 477.

In this paper, the uses of campidol and its modification products in the various body cavities are considered. Rapeseed oil, also known as colza oil, is a vegetable oil, composed of the glycerides of stearic, erucic, and oleic acids. Campidol is only slightly irritating and is of low toxicity, containing approximately 43 per cent elemental iodine. Straight iodized rapeseed oil is satisfactory for the outlining of the tracheobronchial tree. A 4 to 1 dilution with ethyl olive oil is satisfactory for outlining the spinal subarachnoid space, cerebral and peripheral blood vessels, the female genitalia, the lacrymal ducts, the mastoids, and the eustachian tubes. A 50 per cent dilution of ethyl olive oil is satisfactory for outlining nasal sinuses. The author has also used it with success in urography, claiming a minimum of irritative symptoms.

The article contains some excellent roentgenographic illustrations, demonstrating the various uses of campidol.

J. E. HABBE, M.D.

The Preparation of Some Brominated Oils and Brominated Esters. Helen L. Wikoff. Jour. Lab. and Clin. Med., October, 1930, XVI, 36.

The author concludes that the brominated methyl esters of cottonseed oil are the best suited from a chemical and economical point of view as a halogenated product for roentgenologic work. They contain the highest quantity of bromine (42 per cent), are pale amber in color, and of low viscosity.

A. O. HAMPTON, M.D.

DENTAL RADIOGRAPHY

X-ray Negative Teeth. Elmer S. Best. Journal-Lancet, Sept. 1, 1930, L, 427.

A radiograph showing a pulpless tooth, with root, peridental membrane, peridental lamella (socket), and adjacent bone structure intact is not by any means infallible. For years it has been held that until bone absorption at the

apex is evident, such teeth are innocuous, but to make a definite diagnosis as to the effect such teeth have on the health of the individual, simply from the radiograph, is too uncertain. When such teeth are found, the patient should be referred to his physician for thorough examination, and the physician and dentist, in consultation, should decide whether or not there is a probability that these teeth may be a factor in the impairment of health. If so, the dentist must proceed to extract such teeth. Of course, the teeth which show destruction of bone tissue at the root ends or along the sides of the roots should be extracted.

W. W. WATKINS, M.D.

Dental Radiology in its Most Common Applications. Silvio Parenti. *La Radiologia Medica*, August, 1930, XVII, 940.

The radiographic anatomy of teeth is described by the author from the point of view of the modern German school which considers the tooth and the adjacent parts as forming a whole dental organ.

The author describes briefly the endo-oral technic and the new method devised by Winter and Raper. He mentions also the important contribution brought by dental radiology to the diagnosis and therapy of many diseases of the teeth.

L. MARINELLI.

DIATHERMY

The Use of Diathermy in Diagnosis. Julian Arendt. *Röntgenpraxis*, Dec. 15, 1930, II, 1147.

If one applies diathermy to the gall-bladder region for about fifteen or twenty minutes after the intravenous administration of the dye, he is able to obtain a good contrast of the shadow after three or four hours, while regularly the optimum is reached only after a period of from twelve to fifteen hours. Poor concentration may sometimes be avoided by applying diathermy. This is also the case in intravenous pyelography, as diathermy may produce a better concentration, probably by an increase in the blood and lymph circulation.

H. W. HEFKE, M.D.

The Treatment of Dementia Paralytica, with Hyperpyrexia Produced by Diathermy. Clarence A. Neymann and S. L. Osborne. *Jour. Am. Med. Assn.*, Jan. 3, 1931, XCVI, 7.

In 1918, the treatment of dementia paralytica by inoculation with malaria was announced. Other forms of fever treatment have been introduced, notably, relapsing fever, rat-bite fever, and the injection of foreign protein in the form of typhoid vaccine. The literature is filled with vast differences of opinion as to the action of these various forms of hyperpyrexia. The production of fever without the introduction of foreign proteins has been the subject of experimental work on animals and man. The authors used diathermy, while others have produced fever by the use of hot baths. The technic of diathermy treatment to produce elevation of temperature, maintain it, and prevent burning the patient is described in detail. Temperatures can be produced in any patient or, indeed, in a normal human being. The rate of the rise in temperature depends entirely on the mass of the patient, the amount of current introduced, and the efficiency of the insulation.

Certain physiologic phenomena have been observed during and after treatment. A pronounced increase in the pulse pressure is frequently observed, due evidently to an increase in the heart rate and dilatation of the peripheral vessels. After a series of treatments the blood pressure is uniformly decreased and remains permanently at a lower level. The red and white blood corpuscles and hemoglobin increase, and there also seems to be a slight relative increase of the polymorphonuclears and eosinophils and a corresponding decrease of small and large mononuclears. There is an increase in the non-protein nitrogen and uric acid content of the blood. The carbon dioxide capacity of the plasma decreases, while the chlorides in the blood and the calcium in the serum show only a slight tendency toward an increase.

Twenty-five cases of dementia paralytica were treated during eighteen months. Sixteen (64 per cent) made an absolute social adjustment and were able to maintain themselves

outside the institution without supervision. Two (8 per cent) were decidedly improved and were able to maintain themselves with some supervision at home. Seven were unimproved; five of those were totally deteriorated when treatment was begun, one was of the depressive type, and one belonging to the grandiose type died from cerebral hemorrhage. No serious harm resulted to these patients from the treatment and there were no deaths in this series directly or indirectly ascribable to the treatment.

CHARLES G. SUTHERLAND, M.B.

EXPERIMENTAL STUDIES

Experimental Studies Concerning the Effect of Roentgen Rays on the Bone Marrow (Second Communication). Annibale Casati. *Strahlentherapie*, 1930, XXXVIII, 315.

The bone marrow of young rabbits was exposed to a total of 1,600 r (140 K.V. effective, 2 ma., 40 cm. distance, 0.5 mm. Zn + 2.0 mm. Al). Two treatments of 400 r each were given on two successive days; the same was repeated after 14 days. Fifty days following the first treatment, histological studies of the bone marrow showed that the regeneration was fully under way. Cells with round nuclei were predominant both with and without granula. There were only a few cells with segmented nuclei; some transitional cells were also present. Besides these, there were numerous cells forming part of the reticulum, containing granula and appearing similar to the myelocytes. They showed a tendency to develop into mature normal types. Five photomicrograms illustrate the findings.

ERNST A. POHLE, M.D., Ph.D.

Temperature Measurements in the Skin and Their Relation to the Degree of Cooling. Walther Schultze. *Strahlentherapie*, 1931, XXXIX, 303.

One man and two women were brought to the mountains (1,950 meters high) in March, after having spent the Winter in the low lands. Their temperature below the skin was meas-

ured with a thermocouple, built as a needle, which could be inserted from about one-half to one millimeter under the skin. The cooling of the skin was determined by the frigorigimeter of Dorno and Thilenius. A total of 45 experiments was carried out, distributed over cold, moderately cold, and warm days. In all three healthy persons, definite relations existed between the cooling and the temperature within the skin. The author believes that it is more accurate to determine the temperature within the skin than on the surface. He also states that further investigations along these lines are needed in order to establish definite relations between climate and regulation of body temperature.

ERNST A. POHLE, M.D., Ph.D.

Air in the Peritoneal Cavity: Its Effect on the Position and Activity of the Diaphragm. Richard H. Overholt. *Arch. Surg.*, December, 1930, XXI, 1282.

The author had previously reported an elevation of the diaphragm and restriction of its activity in post-operative cases. In this paper he presents results along the same line after injecting air into the abdominal cavity. Dogs were used in these experiments. A reduction in the extent of the diaphragmatic excursions was noted in each instance after the production of a pneumoperitoneum.

HOWARD P. DOUB, M.D.

Experimental Roentgen Injuries of the Heart Muscle. A. Werthemann. *Strahlentherapie*, 1930, XXXVIII, 702.

The author studied the effect of roentgen rays on the heart muscles in rabbits. In the first series (5 animals), the chest was exposed to a front and back field of 5×5 sq. cm. in size. In the second series (6 animals), the field amounted to 12×12 sq. cm. The technic is as follows: 160 K.V., 8 mm. Al, 2.3 ma., 23 cm. F.S.D., 0.55 mm. H.V.L. in Cu, 500 r per field. The animals in the first group tolerated between 17 and 43 exposures and lived from 131 to 343 days. The rabbits in the second group tolerated only from 10 to 15

exposures and died within 65 to 127 days. The histological examination of the hearts showed parenchymal changes consisting of degeneration and atrophy, with marked decrease of nuclei. There were also changes in the interstitial connective tissue consisting of extensive inflammatory infiltration with sclerosis.

ERNST A. POHLE, M.D., Ph.D.

GALL BLADDER (NORMAL AND PATHOLOGICAL)

Primary Sarcoma of the Gall Bladder. Alexander Brunschwig. *Jour. Am. Med. Assn.*, Feb. 28, 1931, **XCVI**, 680.

Primary sarcoma of the gall bladder is rare. Kaufmann states that there are only thirteen cases on record. An analysis of reputed cases establishes an element of doubt in some of them.

One case is reported. The salient feature in the physical examination was a large, smooth tumefaction in the right upper quadrant and upper portion of the right lower quadrant of the abdomen. The mass moved with respirations and could be shifted slightly by manipulation. Routine laboratory examinations were negative. After an intravenous injection of tetiothalein sodium (N.N.R.) there was non-visualization of the gall bladder. Roentgenoscopy showed a displacement of the stomach and duodenum to the left by the tumor mass; a barium enema revealed a downward displacement of the hepatic flexure of the colon. Films of the kidney, ureter, and bladder showed normal kidney shadows and no stones.

Exploratory laparotomy disclosed an enormously dilated gall bladder; about 50 c.c. of colorless fluid was aspirated from this organ. A small portion of the tumor mass was excised from the gall-bladder wall for microscopic examination and the abdomen closed. The patient died within two months after the operation, and a combined study of the biopsy specimen and necropsy material established the diagnosis of spindle-cell sarcoma (with areas of round cells) of the gall bladder.

CHARLES G. SUTHERLAND, M.B.

Cholecystography: A Review of Thirty-four Cases, with Operative Findings. D. B. Harding. *Kentucky Med. Jour.*, December, 1930, **XXVIII**, 596.

In a series of 34 cases in which cholecystography was done, the final roentgen diagnosis in all but one was proved correct by operative findings and pathologic examination. Normal gall-bladder function can occur with a moderate degree of cholecystitis. The negative findings are subject to a considerable degree of error.

W. W. WATKINS, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Value of X-ray Evidence of Bowel Obstruction in Various States of Intestinal Stasis. H. A. Carlson, H. J. Dvorak, F. W. Lynch, C. Borman, and O. H. Wangenstein. *Proc. Soc. Exper. Biol. and Med.*, December, 1930, **XXVIII**, 343.

The finding on the roentgenogram of evidence of gas in the small intestines in experimental simple mechanical obstruction and strangulation has been reported previously by the authors. In this study, X-ray observations have been made in cases of isolated loop obstruction, mesenteric vein ligation, and experimental peritonitis.

Loops of intestine from ten inches to three feet long were formed and obstructed in 23 dogs. End-to-end or lateral anastomosis served to re-establish intestinal continuity. These animals lived for from twenty-one hours to thirteen days, and evidences of peritonitis, discoloration, and distention of the loops were found at autopsy.

The superior mesenteric vein was ligated in three dogs. Two dogs died within 4.5 hours. The other, apparently in good health, was killed after thirteen days. Postmortem examination revealed evidence of collateral circulation, with no distention or discoloration.

In six dogs, experimental peritonitis was produced by introducing liver, liver anaerobes, or bile into the peritoneal cavity and by ligation of the hepatic artery.

Roentgenograms made on the obstructed loop group revealed gas in the loop in from eight to ten hours, with definite distention varying in its appearance, occurring in some cases in eight hours while in others not being definite for a period of more than a hundred hours. Fluid levels were seen in some of the loops. Following ligation of the mesenteric vein, roentgenograms were negative in two cases and variable in the third. Evidence of gas in the small intestine was noted very early in four cases of peritonitis but was not observed in two cases.

J. N. ANÉ, M.D.

Solitary Diverticulitis of the Cecum. A. Stewart. Canadian Med. Assn. Jour., November, 1930, XXIII, 675.

The following case report is presented because of the rarity of the condition, only eight similar cases having been reported in the literature.

The patient complained of a sudden acute onset of abdominal pain, centering later at the right lower quadrant of the abdomen. The diagnosis of the referring physician was sub-acute appendicitis, which was confirmed after examination in the hospital. Under ether anesthesia, a mass was felt in the right lower quadrant of the abdomen. On operation the mass was found to be in the posterior wall of the cecum. It was hard and firm but did not have the clinical characteristics of a carcinoma. The cecum was resected and an anastomosis made between the ileum and the ascending colon. Pathologic examination of the mass showed it to be external to the cecum, containing a cavity in which there was a fecalith. The cavity was connected with the cecum by a minute opening. The diagnosis made was infected diverticulum.

L. J. CARTER, M.D.

The Lower Esophagus and Upper Portions of the Stomach as Seen by the Roentgenologic Examination. Josef Palugyay. Röntgenpraxis, Feb. 1, 1931, III, 117.

For a roentgenologic examination of the lower part of the esophagus and the upper part of the stomach, it is necessary to employ

liquid barium, as well as a thick barium paste. A mixture of equal parts of barium and paraffin oil for the latter purpose can be stored for months. The patient must not only be examined in the upright position but also lying down, with elevation of the pelvis. The normal passage of barium through the cardia shows physiologic differences, depending on the consistency of the contrast medium and the position of the patient. Pathologic disturbances in the passage of barium through the cardia are caused most frequently by cardiospasm or carcinoma; cicatricial strictures, ulcers, diverticula, or compression by diseases of the neighboring organs must also be considered. However, these are seen less frequently. A cardiospasm which has led to dilatation and elongation of the esophagus usually causes no difficulties in making a diagnosis. That type of cardiospasm, however, which does not lead to these secondary changes, makes it more difficult. Organic lesions, especially small neoplasms of the cardia, stomach, or esophagus, lead to early symptoms of such a spasm, and only repeated examinations can help to differentiate between the two types.

Pathologic lesions of the surrounding organs may occasionally be mistaken for a carcinomatous obstruction in the cardiac region, such lesions being inflammatory or neoplastic enlargements of the cardiac glands or metastatic nodes in the left lobe of the liver. Ulcers of the lower esophagus are rare and may be differentiated from a carcinoma by the more regular outline and the absence of infiltration of the wall. Smooth and more extensive, multiple strictures are more or less typical for cicatricial strictures caused by caustics. Diverticula are usually easily diagnosed; however, food remnants in them may occasionally simulate a malignant growth. Although it is possible to make a roentgenologic diagnosis in a greater number of the cases, the lesions of the lower esophagus, cardia, and upper portions of the stomach have often been incorrectly diagnosed, and diagnostic methods in this region must be applied with more care and endeavor.

H. W. HEFKE, M.D.

Peptic and Duodenal Ulcer in Tabes Dorsalis. Edward L. Hunt and James R. Lisa. *Jour. Am. Med. Assn.*, Jan. 10, 1931, **XCVI**, 95.

The combination of ulcer and tabes is uncommon. Four cases are reported in detail of gastric and duodenal ulcer with tabes dorsalis. The ulcers in these four patients showed no evidence either of syphilis or of a malignant condition, but did show the changes characteristic of the simple ulcer. In none of the ulcers were spirochetes found. The conclusion is that the presence of the two conditions must be a coincidence, but if four such combinations are found in one hospital in the same calendar year, the condition must be more common than is supposed. Neurologists and internists should be on the alert for this combination and suspect every gastric crisis. They have no doubt but that some of their patients might have survived had the ulcer been diagnosed.

CHARLES G. SUTHERLAND, M.B.

Diverticulitis of the Colon, with Special Reference to Acute Perforations of the Sigmoid. R. W. Whitman. *West Virginia Med. Jour.*, September, 1930, **XXVI**, 544.

Diverticula are found in any part of the alimentary tract, but most frequently in the large intestine. This discussion is concerned with diverticulitis of the colon and especially of the sigmoid. Diverticula may be true or acquired. In the former, all layers of the intestinal wall are included; in the latter there is herniation of the mucosa through the weakened muscular layer, leaving only mucosa, submucosa, and peritoneum forming the sac. So long as diverticula remain free from infection, their presence is of little consequence, but, like the appendix, if they become infected, there is a different matter with which to deal. The differential diagnosis between diverticulitis and carcinoma of the colon is always difficult. A careful study of the symptoms, with competent X-ray examinations, are the main steps in the diagnosis. Spriggs, in 1,000 consecutive cases of X-ray study of the colon in patients with abdominal complaints, found

about 10 per cent of them with some phase of diverticulosis. It is important to discover the presence of diverticulosis before it develops into surgical diverticulitis.

W. W. WATKINS, M.D.

A Case of Aleukemic Leukemia of the Stomach and its Roentgenologic Findings. Václav Šváb. *Med. Klinik*, Dec. 24, 1930, **XXVI**, 1922.

This is the report of a case which clinically impressed one as a cholecystitis. The roentgenologic examination showed a very marked hypertrophic gastritis, with multiple polyps. During the operation, a marked thickening of the gastric wall and hypertrophy of the mucous membrane were found—histologically, an aleukemic lymphadenosis.

H. W. HEFKE, M.D.

A Gastro-jejuno-colic Fistula, with a Barium Enema Entering the Esophagus. Clinton G. Lyons. *United States Vet. Bureau Med. Bull.*, December, 1930, **VI**, 1076.

The patient, a man, aged 35, had "stomach trouble" for eleven years. In 1925, a gastro-enterostomy was performed after a diagnosis of duodenal ulcer had been made. Following this, he suffered no pain but complained of fecal vomiting, loss of weight, and diarrhea, which increased in severity. The physical examination revealed an emaciated and anemic individual with tenderness in the epigastrium. Examination of the blood showed an anemia, 11,800 white blood cells, with 88 per cent neutrophils.

During the fluoroscopic examination the opaque enema was seen to fill the colon to the splenic flexure, when many small streams of the barium mixture were noticed crossing the abdomen in various directions. A barium column was seen to enter the stomach through the gastro-enterostomy and was visualized in the lower and middle thirds of the esophagus. A subsequent examination, with the barium meal, revealed the immediate filling of the stomach, small intestine, descending colon, sigmoid, and rectum.

J. N. ANÉ, M.D.

Misplacements of the Cecum and Ascending Colon. Giacomo Bagnaresi. *Archivio di Radiologia*, January-February, 1931, VII, 1.

The author reports two cases of subhepatic ectopy of the cecum which were diagnosed radiologically, and gives a brief discussion of the causes which may produce this anomaly. He insists upon the absolute necessity of making a complete X-ray examination of the whole gastro-intestinal tract in these patients, and calls the attention of radiologists to the importance of the oblique and lateral projections in this examination. He next considers the periodicity of pain in this condition of the large intestine, and points out the frequent coincidence of the disappearance of pain and the migration of the colon.

E. T. LEDDY, M.D.

The Diagnosis of Malignant Conditions of the Colon. Fred W. Rankin. *Minnesota Med.*, November, 1930, XIII, 797.

The most important early symptoms of carcinoma in any portion of the colon are change in intestinal habit, as evidenced by irritability, mucous diarrhea, alternating diarrhea and constipation, localized pain and tenderness, tumefaction, profound anemia not accompanied by loss of blood, and obstruction of varying degree. If any of these symptoms present themselves, the patient should immediately undergo, at the hands of a competent roentgenologist, a complete gastro-intestinal examination, with great assurance that the suspected lesion will be discovered. Loss of weight, cachexia, dehydration, and desiccation are not symptoms of carcinoma of the colon but evidences of metastasis and impending dissolution. To wait for these before making a diagnosis is but to be party to a fatal delay.

W. W. WATKINS, M.D.

The Early Diagnosis of Carcinoma of the Stomach. Leo G. Rigler. *Minnesota Med.*, November, 1930, XIII, 784.

Unfortunately all patients who come to the physician complaining of gastric symptoms cannot be examined by the X-ray and some

selection must be made. Every patient past the age of forty, with a gastric complaint, should be a cancer suspect, and must be examined with the greatest care. Two procedures should always be undertaken, in addition to the usual examinations. First, gastric analysis for free HCl; second, stool examination for occult blood. If either HCl is absent or occult blood present, then a thorough and competent roentgenoscopic and roentgenographic examination of the stomach should be made.

The X-ray examination of the stomach is the most exacting type of roentgen examination to make, and perhaps is one of the most difficult diagnostic procedures in medicine. The importance of experience and competence on the part of the roentgenologist, therefore, cannot be overestimated. The possibility of overlooking a small carcinoma of the stomach is so great and the consequences so serious that the greatest care must be exercised, and adequate equipment is essential. In experienced hands the procedure is one of the most accurate in medicine, and the early diagnosis and cure of stomach cancer would be greatly facilitated if more patients with gastric complaints were thoroughly examined by the X-ray.

W. W. WATKINS, M.D.

Observation on the Motility of the Gastro-intestinal Tract of Starving Rats. Leon J. Menville, J. N. Ané, and S. N. Blackberg. *Proc. Soc. Exper. Biol. and Med.*, December, 1930, XXVIII, 249.

The authors studied the effect of a starvation diet on the gastro-intestinal motility of normal healthy white rats. Five rats were fasted for 24 hours and, subsequently, each rat was fed 2 grams of normal food a day for a period of 21 days. All of the rats lost weight and two died, one on the tenth and the other on the fifteenth day of the experiment. As controls, three normal rats of approximately the same weight were fed 14 grams each of the same food per day.

On the twenty-first day of this experiment, all rats were fasted for 24 hours and then fed a 10-gram mixture of three parts of butter-

milk to one part of barium sulphate. They were permitted to eat for 20 minutes and then immediately fluoroscoped. The fluoroscopic examinations were continued every 15 minutes until the stomach and small intestines were found empty. Examinations of the colon were made at greater intervals of time.

A marked hypermotility of the entire gastro-intestinal tract was observed in each of the rats that had been fed a starvation diet.

Roentgenologic Examination of the Colon. Hans H. Berg. *Röntgenpraxis*, Feb. 15, 1931, III, 145.

A general discussion of the technic, tactics, and results of the roentgenologic examination of the colon is given. A flat film of the abdomen may sometimes reveal evidence of an obstruction. The observation of the passage of the contrast medium deserves mention for its value in functional changes, but its place is taken by the barium enema method when morphologic changes are to be shown. Careful preparation (preferably by enemas) is very essential, as retained fecal material may lead to errors. The capacity of the colon is variable. Irritation (after cathartics and cold enemas) may decrease but may, on the other hand, be increased by colitis. In order to be able to study the mucosa of the colon a small amount of barium is used, which leads to the filling of the cecum. If there is a question of infiltration and fixation of the wall of the colon, the combination, with inflation of air (Fischer), is used. The study of the mucosa itself is undertaken after the colon is evacuated. Complete emptying speaks for colitis.

If there is yet a question, Fischer's method of air inflation is used again. It is not necessary to use all of these modifications in the examination of every patient. The direct signs of disease are by far the most important symptoms. Their demonstration is often possible by fluoroscopy, but must be confirmed by the X-ray films. The use of the Bucky diaphragm is now standard practice.

The roentgenologist must have a chance to take the history of the patient and follow his own course of procedure, otherwise delay and

wrong diagnoses might result. In fact, the failure of a roentgenologic examination in cases of colonic carcinoma can be attributed generally to faulty methods; for instance, the ordering of a colonic examination by means of a barium meal and the failure to send the patient back for a barium enema, although that may have been suggested by the roentgenologist. Changes in the position of the colon without manifest disturbances in the passage of the barium are of no importance. Ptosis should not be called a disease, while adhesions without delay in the passage of the contrast medium are often of no clinical importance. The direct roentgenologic signs of disease of the colon are of more importance than the functional disturbances.

H. W. HEFKE, M.D.

Some Interesting Cases of Hypertrophic Pyloric Stenosis. R. R. MacGregor. *Canadian Med. Assn. Jour.*, February, 1931, XXIV, 269.

The author discusses briefly the historical aspect of pyloric stenosis. The condition was described as early as 1777, by George Armstrong, an English physician. But it was not until 1888 that the contribution of Hirschsprung awakened general interest. Reports of cases in increasing numbers followed his writing. Various unsuccessful methods of treatment were in vogue, until Rammstedt, in 1912, devised the operation of pyloroplasty, which has been so successful in relieving the condition.

The three cases reported have some interesting features, especially in relation to the causative factors in this condition. One patient, a woman, had three children before the War, all of whom were normal. She suffered intense anxiety during the War when her husband was overseas. Three of the four children born following the War had pyloric stenosis. This leads to the speculation as to whether or not the highly nervous state of the mother, which continued following the War, had any effect on the occurrence of the pyloric stenosis in the three children. It also leads to speculation as to whether or not the special nervous instability which precedes a first labor

has any effect on the frequency with which pyloric stenosis occurs in the first-born.

L. J. CARTER, M.D.

GASTRO-INTESTINAL TRACT (THERAPY)

Contributions to the Study of Chronic Stenosis of the Duodenum. R. Appelmans, F. Van Goidsenhoven, and J. Boine. *Revue Belge des Sciences Médicales*, January, 1930, I, 1.

The symptoms of chronic stenosis of the duodenum are dull, aching, epigastric distress occurring periodically after eating, with nausea, at times vomiting, almost simulating gastric crises. Lying prone generally gives relief. The causes of duodenal stenosis are:

(1) Most commonly a compression about the superior mesenteric artery upon the ascending third portion of the duodenum;

(2) a short mesentery of the transverse colon in which runs the middle colic artery;

(3) primary periduodenal adhesions, but most commonly by secondary adhesions from a healing duodenal or pyloric ulcer;

(4) pressure from a tumor in a neighboring viscus or pericholecystitis.

Radiographically, the diagnosis is certain, with dilatation of the duodenum, stasis of its contents, and exaggerated peristalsis of the duodenal contents into the stomach. The pylorus becomes patent at all times. These observations are best made in the erect posture. A colonic enema simultaneously given with barium by mouth is often necessary to distinguish between Causes 1 and 2 (see above); when the colon is filled there is stasis of the duodenum and no stasis when the colon is empty.

Medical treatment is by use of the prone or knee-chest posture, after eating, in mild cases. When visceral ptosis and constipation are secondary causes, abdominal muscle strengthening exercises and appropriate abdominal support often give relief. Surgical treatment by duodeno-jejunostomy or gastro-jejunostomy gives excellent results. An extended bibliography accompanies this article.

CHARLES S. CAPP, M.D.

The Present Consideration and Care of the Colon. John A. Lichty. *Jour. Am. Med. Assn.*, Feb. 28, 1931, XCVI, 649.

Chronic ulcerative colitis is at present receiving intensive study, and a voluminous, controversial literature is about the only definite result as yet.

Among the functional disturbances of the bowels are certain irregularities due to an atonic condition at times or, again, to a spastic condition of the colon. With disturbances of motility there are also secondary disturbances such as mucous colitis and catarrhal conditions which may occur. Other functional disturbances are dilatation and sagging of certain parts of the colon, due either to congenital defects or to developmental changes. Extraperitoneal folds are formed from attempts at a compensatory restoration of function. Also on account of continual traumatic insult there may develop web-like adhesions. The chief concern is that the diagnosis shall represent the real condition present and suggest the course of treatment. There is no diagnostic procedure more helpful in determining the true condition of the colon than the roentgen examination. It reveals, among other things, the abnormally spastic or atonic colon, and excludes organic changes.

In the treatment, alteration of diet may readily modify or change the intestinal flora and result in a more definite change than the majority of other methods of treatment ordinarily employed.

CHARLES G. SUTHERLAND, M.B.

Acute Intussusception in Infancy: Operative and Non-operative Treatment. David M. Siperstein. *Arch. Pediatrics*, January, 1931, XLVIII, 31.

Intussusception is typically a disease of infancy, the majority occurring under one year of age. The author follows Monrad's classification: Large intestine invaginations, (a) colic, (b) ileocecal; small intestine invaginations, (a) ileac, (b) ileocolic; 90 per cent are ileocecal and ileocolic.

The four cardinal symptoms are: sudden severe recurring abdominal pains, vomiting,

blood and mucus in the stool, and a palpable tumor.

The treatment is divided into the so-called bloodless method and the surgical method. The bloodless approach may be subdivided into: (a) dry taxis; (b) air inflation, and (c) fluid (water or barium) injection by rectum. The barium enema is of value in diagnosis as well as treatment.

Mortality statistics of the various forms of treatment tend to show that with proper selection and precaution the non-surgical methods compare favorably with the surgical. They should complement each other under careful supervision. It is only with the surgical treatment that one can be sure of complete reduction, and in all doubtful cases it is the treatment of choice.

E. C. VOGT, M.D.

The Treatment of Peptic Ulcer with Gastric Mucin: Preliminary Report. Samuel J. Fogelson. *Jour. Am. Med. Assn.*, Feb. 28, 1931, **XCVI**, 673.

The ideal therapeutic agent for use in combating the irritative action of gastric juice in peptic ulcer is one that will neutralize or combine with the acid without materially affecting gastro-intestinal activity, and without having a general systemic action. Alkaline powders are not ideal. In the literature on gastric secretion, the capacity of mucus to lower the free acid in the stomach is repeatedly suggested.

Physiologic observations suggested gastric mucus as an ideal antacid in that (a) it combines readily with the free acid, (b) it is a natural substance which plays normally a protective, soothing, and lubricating rôle in the functioning of mucous membranes, and (c) its secretion or ingestion causes no chemical disturbances in the body and no unfavorable effect on gastro-intestinal secretory or motor activity.

An ideal preparation of mucus was prepared. Animal experimentation proved that the mucin has a high combining power with free acid *in vivo*. Encouraged by the results in animal experimentation, the author extend-

ed the experiments to cases of peptic ulcer in man.

Twelve patients were treated; in ten of these, the roentgen appearances were those usually interpreted as characteristic of duodenal ulcer. One of the remainder had a gastric resection and the other had a gastro-enterostomy; both had a major complaint of pain after eating. Each patient was given one ounce of powdered mucin with each meal, incorporated in ice cream or similar frozen foods, or in thick drinks such as malted milk. From 20 to 40 grains were given in tablet form, either hourly or half-hourly, when the patient had severe pain or when the fractional Ewald test meal showed unusually high free acid. In all twelve patients the subjective symptoms disappeared within three days of treatment, the most gratifying feature being the persistent absence of pain, which did not recur despite two grave dietary indiscretions in two patients with alcoholic tendencies.

As yet, difficulties have not been encountered from excessive quantities of mucus in the stools nor has any patient shown any ill effect from being fed such large quantities of mucin. It is realized that periods of observation varying from two to five months cannot justify any thought of cure, but since mucin, from a theoretical and experimental point of view, proves to be practically ideal, an extensive clinical trial is indicated.

CHARLES G. SUTHERLAND, M.B.

GENITO-URINARY TRACT (DIAGNOSIS)

The Principles of Intravenous Urography. Alexander von Lichtenberg. *Jour. Urology*, March, 1931, **XXV**, 249.

Indications, limitations, and clinical evaluation of intravenous urography, based on a series of over 700 cases, are considered. Following several attempts to obtain a suitable urographic medium, uroselectan was finally evolved and fulfilled all of the requirements. Its clinical success was based upon its ability to give a sufficient concentration to serve as a contrast substance to visualize the urinary tract with regularity and surety. It is eliminated in the urine in high concentration, ren-

ders good visualization, and is non-toxic in the quantity necessary for intravenous urography. One hundred c.c. of a 40 per cent solution are employed; the first urogram is taken one-quarter of an hour, the second three-quarters of an hour, and the third an hour and a quarter after the intravenous injection.

The information which may be derived from the use of uroselectan consists of the following: (1) Visualization of the urinary tract and principally the relationship of its component parts; (2) determination of renal function by both roentgenologic and chemical means, and (3) interpretation of the dynamics of the urinary tract.

Good visualization results only when the kidney function is satisfactory. The functional state of the kidney determines the intensity of the urogram. It is also influenced by the uroselectan threshold of the kidney. Occasionally a normal functioning kidney may fail to produce a marked intensity. Concentration may be intensified by obstruction. Visualization is poor or delayed when the renal parenchyma is damaged. An important insight into the pathology and physiology of the urinary tract is permitted by this method. Systolic contraction of the urinary apparatus prevents complete filling.

The author has made the following deductions from his experience with intravenous urography: (1) Minor disturbances of kidney function cannot be evaluated. The functional "proving" by roentgen visualization is not a precise method; (2) it is satisfactory for the judgment of surgical lesions and clinical interpretation; (3) localization of the diseased side in unilateral conditions is facilitated. In bilateral lesions the relative severity of each kidney may be decided upon, and a clinical diagnosis regulating the course of procedure suggested thereby; (4) interpretation of dynamics and observation of peristaltic conditions are rendered available.

The elimination of the contrast medium by the kidney can be observed by means of roentgenology. The iodine content excreted in the urine may be estimated and the specific gravity determined following the intravenous injection. The quantity of uroselectan in the

blood may be utilized as a retention test similar to the indican determination. The quantitative test in the urine is not sufficiently accurate to be accepted as a clinical index of renal function. The author advocates the retention test as a reliable estimation of kidney efficiency. Any quantity exceeding 0.5 of a gram indicates renal damage. The injection of uroselectan into the blood stream does not affect the clotting time or sedimentation test.

From a clinical point of view, intravenous urography is indicated in the following conditions: (1) Wherever cystoscopy, ureteral catheterization, or instrumental pyelo-ureterography are impossible, due to anatomical, pathologic, or technical reasons; (2) obstruction in the ureter, making retrograde injection impossible; (3) in cases in which instrumental pyelo-ureterography involves a risk to the patient.

The discussion of the paper is fairly in accord with the author's conservative views and claims. That uroselectan is a marked advance in urologic diagnosis and a valuable adjuvant is asserted by everyone, yet retrograde pyelography and cystoscopy retain their positions in urologic procedures.

DAVIS H. PARDOLL, M.D.

New Technic for Roentgenographic Study of Renal Vessels. G. Milles, E. F. Müller, and W. F. Petersen. *Proc. Soc. Exper. Biol. and Med.*, January, 1931, XXVIII, 351.

In order to study the changes induced by the action of various agents on the renal vessels during life, the authors were able to visualize these vessels in dogs, by adapting the method of Hill and Graham to this purpose. The method of Hill and Graham, involving the injection of a 25 per cent bismuth oxychloride suspension in 10 per cent acacia, was applicable to postmortem material.

Under general anesthesia and using a left paravertebral incision, the aorta was exposed and clamped below the level of the renal vessels. At a point above this, 50 c.c. of a 25 per cent suspension of bismuth oxychloride without acacia was then injected into the aorta. The puncture point in the aortic wall

was clamped, and after from five to ten minutes the kidneys were removed and the animals killed. The kidneys were hemisected and roentgenograms were made, using low voltage and low milliamperage, with the three to five second exposure.

The results were less satisfactory when injections into the aorta were made below the origin of the renal vessels, with or without occlusion of the aorta above this level.

Visualization of the finer interlobular vessels was uniform throughout in normal animals. When an old animal with microscopic evidence of renal vessel alterations was injected, the roentgenogram revealed incomplete and patchy injection of vessels, with a roughly beaded appearance.

J. N. ANÉ, M.D.

The Technic of the Roentgenologic Demonstration of the Urinary Tract with Abrodil. J. Becker. *Röntgenpraxis*, Feb. 15, 1931, III, 185.

The best method of demonstrating the kidney pelvis and ureters in children after the intravenous injection of Abrodil (known as skiodan in the U. S. A.) is to elevate the pelvis shortly after the injection. This seems to assist in producing a good shadow of the kidney pelvis and is easier than the method of compression of the ureters.

H. W. HEFKE, M.D.

The Value and Limitations of Uroselectan as an Aid in Urological Diagnosis. Henry G. Bugbee and Arthur J. Murphy. *Jour. Urology*, March, 1931, XXV, 275.

Uroselectan was employed in a series of twenty-six cases. The authors state that while a remarkable addition has been made to the field of urology, the utilization of this method is limited. Primarily, it is to be employed as a means of corroboration and as a supplement to our present method of urologic diagnosis. In a limited number of patients in whom cystoscopic manipulation is impossible, many valuable data, otherwise unavailable, are obtained. The interpretation of such data, however, unsupported by cystoscopic information,

must be made with extreme care and conservatism.

The article is accompanied by a résumé of the cases studied, and contains many interesting illustrations.

DAVIS H. PARDOLL, M.D.

Observations on the Diagnosis and Treatment of Renal Calculi. Gordon S. Foulds. *Canadian Med. Assn. Jour.*, January, 1931, XXIV, 79.

A review of 45 cases of renal calculus treated on the Urological Service at St. Michael's Hospital, Toronto, emphasizes three problems, relative to the diagnosis and treatment of renal lithiasis: (1) The amount of destruction that occurs in the kidney as the result of the presence of stone; (2) the frequency with which renal calculi go unrecognized over long periods of time, and (3) the number of cases met with that have had previous operations for the relief of symptoms which, in many instances, are related to the presence of stone in the kidney.

The first problem referred to above is emphasized by statistics. Chute, in a review of 50 cases, found 19 in which destruction or severe impairment of the kidney occurred as the result of the presence of calculus. In the author's review of 45 cases from the Mayo Clinic, 17 had a definite calculous pyonephrosis.

With regard to the second problem, namely, the frequent delay in making a diagnosis of renal stone, the main factor is the frequent absence of typical renal colic symptoms in nephrolithiasis. Prior to the days of the X-ray and the cystoscope, many of the "silent" calculi went unrecognized until the postmortem revealed the extensive kidney damage. Hence the X-ray must be routinely employed, and we should not wait for the classical symptoms of renal colic, associated with hematuria.

The third problem, namely, the frequency with which operation was done for some other thing when renal stone was the cause of the symptoms, is emphasized by the frequency with which appendectomy is done for the relief of symptoms which are really caused

by renal stone and not by the appendix. In the author's review of the cases, he found that one-quarter of the patients had had a previous appendectomy for the relief of symptoms without success. More than twice as many appendices were removed in patients with right-sided stone, as compared with those harboring a left-sided stone.

L. J. CARTER, M.D.

Comparative Value of Uroselectan to Cystoscopic Pyelography. Robert H. Herbst. *Jour. Urology*, March, 1931, XXV, 287.

The indications for intravenous urography and a comparative evaluation of both methods are published by the author. He finds the intravenous method particularly useful in the examination of the urinary tract in children. Its applicability and ease of administration recommend its employment. In cases in which cystoscopy is either impossible or inadvisable, this method is of obvious advantage. The danger of bilateral visualization, and artefacts due to over- or under-distention by the retrograde method, is eliminated.

In tumors of the kidney, polycystic malformation, and early tuberculosis, visualization is much better with retrograde urography. The value of uroselectan as a function test is noted. Also when ureteral catheterization is found to be impossible for various reasons, intravenous injection finds considerable favor.

Idiosyncrasy to uroselectan must be borne in mind, although manifestations of toxicity have never been observed in the author's experience. Further commentaries upon the comparative value of uroselectan are mentioned by the author.

DAVIS H. PARDOLL, M.D.

Studies in Renal Denervation. I.—Roentgenographic Demonstration of Vascular Alteration. G. Milles, E. F. Müller, and W. F. Petersen. *Proc. Soc. Exper. Biol. and Med.*, January, 1931, XXVIII, 354.

The authors demonstrated, by means of the roentgen ray, the changes which occur in the renal vascular bed, as a result of denervation. In the majority of cases they found these

alterations to consist of enlargement of the kidney, dilatation of the renal vessels, and increase in the number and projections of the interlobular arteries to the outer margin of the cortex. In a much smaller series, the denervated kidney was found to have decreased in size. The number and size of the renal vessels were likewise decreased.

Using anesthetized dogs, their method involved the operative exposure and delivery of one kidney through the incision. All vessel sheaths, including the adventitia of the renal artery, were removed and all visible nerves were divided. At the end of two weeks, following the new technic devised by the authors, the renal vessels of these animals were injected, using bismuth oxychloride to render them opaque to the X-rays.

J. N. ANÉ, M.D.

The Value of Uroselectan in Renal Lithiasis. William F. Braasch. *Jour. Urology*, March, 1931, XXV, 265.

Intravenous urography is of particular value in (1) identification of renal shadows; (2) determination of the intra-renal situation of shadows; (3) ascertaining the differential renal function; (4) demonstration of coincident disease or anomaly in the affected kidney, and (5) determination of the functional capacity and disease or abnormality in the other kidney.

In the identification of renal shadows, errors are possible, and both methods of urography should be resorted to whenever any doubt exists regarding the accuracy of the diagnosis. The affected renal pelvis and ureter may be more clearly outlined because of stasis or delay in excretion.

To determine the relative position of the kidney pelvis and an extra-renal shadow, exposures in different positions, together with displacement of the kidney, may be resorted to, with intravenous urography. When uroselectan is employed to demonstrate calculi, the outline of the latter stands out in sharp contrast to the urographic medium, which is usually of a lesser density. It is of particular value in cases of calculi at the end of a calyx.

Information regarding the exact position, feasibility of removal, and evidence of stasis is obtained much more satisfactorily with the intravenous method.

Uroselectan offers a more accurate and satisfactory test of function than either phenol-sulphonephthalein or indigo-carmin in calculous disease of the kidney. That bilateral involvement of the kidney occurs more often than was previously supposed is demonstrated by the intravenous method. Many slight abnormalities in the pelvis of the opposite kidney are observed, including clubbing and stasis in the calices. Unsuspected anomalies are often revealed by uroselectan.

Intravenous urography eliminates febrile reactions following instrumental manipulation, and in cases in which retrograde pyelo-ureterography is impossible, valuable information may be made available by the utilization of direct urography. It is of value in determining the renal function and degree of pyelectasis, and serves as an indicator regarding the degree of destruction in the kidney.

Ureteral spasms are often eliminated by this method. The bladder should be emptied in cases of stone in the lower ureter, so that the shadow or filling defect will not be obliterated.

DAVIS H. PARDOLL, M.D.

Renal Carbuncle. Thomas D. Moore. *Jour. Am. Med. Assn.*, March 7, 1931, XCVI, 754.

Carbuncle of the kidney may be defined as a metastatic, circumscribed, conglomerate suppurative process, usually caused by *Staphylococcus aureus*, having its origin in some superficial focus, such as a furuncle, paronychia, or carbuncle. The few cases reported in the literature not only may denote the rarity of the disease but also may be construed as indicating the difficulty of diagnosis. It is interesting to note that perinephric abscess was present in 15 of the 42 reported cases.

Five cases are reported and reviewed. Pyelograms revealed soft tissue shadows, deformities of the pelvis and ureters from pressure, destruction of normal structures, and in one, an elongation of the calices. The chief diagnostic difficulties are: (1) The almost com-

plete absence of localizing symptoms is not unusual unless perinephric abscess complicates; (2) urinalysis may be practically negative, as in 33 of the 47 cases; (3) a long period elapses between the original skin focus and the symptoms referable to the renal infection (in 25 cases this interval averaged 31 days); (4) pyelography displays no characteristic features; (5) differential functional tests are of great value and may constitute the only clue to the presence of the renal lesion.

Surgical intervention is usually imperative, nephrectomy being the treatment of choice. In cases complicated by perinephric abscess, preliminary drainage is desirable prior to nephrectomy.

CHARLES G. SUTHERLAND, M.B.

Intravenous Urography. William F. Braasch. *Am. Jour. Roentgenol. and Rad. Ther.*, February, 1931, XXV, 196.

Reactions following the intravenous injection of uroselectan were at first of some severity and frequency, but at the present time, with smaller doses and newer preparations, such as skiodan, these are largely of only historical interest. While at times the desired urologic information may be obtained by intravenous pyelogram alone, the information thus obtained must often be supplemented by cystoscopy and sometimes pyelography. Unsatisfactory intravenous pyelograms are obviously as misleading and unreliable as unsatisfactory retrograde pyelograms. One pathologic condition most reliably shown by the intravenous method is stasis, the result being a clearly outlined dilated pelvis or ureteral shadow, if renal function remains reasonably adequate. With minor deformities of the pyelogram shadow, such as may be present in tuberculosis or tumor, the retrograde pyelogram is usually decidedly more accurate. Anomalies of the urinary tract will probably be shown more often in cases in which intravenous pyelography is used routinely, than was possible in the past.

The author believes the intravenous pyelogram at times to be a fairly satisfactory test of renal function, and states that the case

showing good visualization of the kidneys, pelvis, and calices within from ten to fifteen minutes after the injection, is probably one with normal function. One may also determine the amount of iodine secreted in the urine. In the normal case, the specific gravity of the urine may increase to 1.045, because of the rapidity of iodine elimination. The author emphasizes the observation of several other writers that failure to obtain definite visualization of the renal interior does not absolutely mean absence of kidney function.

J. E. HABBE, M.D.

Intravenous Urography in the Diagnosis of Renal Tuberculosis: Case Report. Theodore Sweetser. Jour. Urology, March, 1931, XXV, 311.

A case of unilateral renal tuberculosis is reported in which it was found impossible to catheterize the ureter on that side. A question of extra- or intra-renal pathology was involved and was clarified by obtaining visualization of the urinary tract through the use of uroselectan by the intravenous injection, which demonstrated intra-renal tuberculosis. The patient was operated upon and made an uneventful recovery.

DAVIS H. PARDOLL, M.D.

An Unusual Case of Unilateral Renal Bleeding. Emerson Smith. Canadian Med. Assn. Jour., February, 1931, XXIV, 268.

This is a report of a case of blood in the urine which had continued for ten days. The X-ray examination of the urinary tract was negative for stone. Cystoscopy showed the urethra and bladder to be normal, and the urethral orifices were of normal position and contour. There was free bleeding from the right ureteral orifice. The ureters were catheterized with ease. A pyelogram of the right side demonstrated a normal pelvis, and all the calices were found to be well developed and defined.

As the bleeding continued and the blood count was steadily falling, the patient was operated upon and a right nephrectomy performed. The pathologic report showed a nor-

mal kidney, with the exception of a small flat ulcer at the superior margin of the upper calyx. The hematuria was due to the rupture of a small dilated vein at the base of the ulcer. Apparently no local or other measures had been used to attempt to control the bleeding—measures which probably would have obviated the loss of the kidney.

L. J. CARTER, M.D.

Excretion Urography with Abrodil (Skiodan). Georg Woytek. Röntgenpraxis, Jan. 15, 1931, III, 59.

From 15 to 20 gm. of abrodil (skiodan in the United States) are diluted in 50 c.c. of re-distilled water. Filtering the solution does not seem necessary on account of the good solubility of the substance. Paravenous deposits do not lead to tissue destruction, and the optimal contrast may be obtained between fifteen and twenty-five minutes after the injection. Urine examinations after this method have not revealed damage to the kidneys. Rectal administration of 20 gm. was unsuccessful. After using 30 gm. one could demonstrate the urinary tract but the contrast was less than after the intravenous method. The peroral method seems very uncertain and has not been tried. Compression over the sacroiliac region leads to a better contrast in suitable cases, but such mechanical means are not absolutely necessary. One must admit that compression, if successful, assists in obtaining a clear roentgenogram. Abrodil (skiodan), as compared with uroselectan, has the advantage of better solubility, deeper contrast, and less expense.

H. W. HEFKE, M.D.

Uroselectan for Intravenous Pyelography. J. C. McClelland. Canadian Med. Assn. Jour., February, 1931, XXIV, 213.

The author gives a brief résumé of the history of intravenous pyelography. Uroselectan is a synthesized derivative of pyridine. It is readily soluble, non-toxic, and is eliminated by the kidneys in sufficient concentration to give an outline of the urinary passages.

The amount of uroselectan eliminated is dependent upon the kidney function, and the concentration eliminated is 5 per cent, which will not give as good a "picture" as the 12 per cent sodium iodide used in instrumental pyelography. Better films are secured in the presence of any obstruction, when a greater concentration of the medium is secured. Severe bilateral parenchymal lesions give poor films, the excretion of the dye being much delayed. Being eliminated by the glomeruli, no shadow is seen in the presence of glomerular disease. In tubular disease good films are obtained.

The blood clotting time and sedimentation time are not interfered with, and there is no danger of thrombosis or emboli.

The author regards the chief use of this method as supplementary to the use of instrumental pyelography. The combination of the two methods enables one to make a complete diagnosis. He warns against the use of the method by those untrained in urology.

A number of excellent reproductions of X-ray films are shown, illustrating both the uroselectan method and the instrumental method of pyelography in the same patient.

L. J. CARTER, M.D.

Roentgenological Control of Exposed Kidneys in Operations for Nephrolithiasis, with the Use of Special Intensifying Cassette. Edwin Beer. *Jour. Urology*, February, 1931, XXV, 159.

A much more conservative attitude of surgery toward both ureteral and renal calculi has been noted in the last twenty-five years. Renal stones present a much more complicated problem, because of their recurrences, and bilateral incidence.

In many instances, cases of renal lithiasis demonstrated what was considered recurrences upon post-operative roentgenography. The possibility of fragments and even stones of large size which cause unfortunate complications as nuclei for these recurrences has more recently dawned upon various men.

George Brewer was the first to advocate the X-ray examination of the exposed kidney in the operating room. Fluoroscopy was advo-

cated by Braasch, Carman, and others at the same time, but experience taught them that with the latter, small fragments frequently escaped observation. Quimby next advised placing a film against the exposed kidney and taking an X-ray of the organ.

The author advocates the use of a new cassette which permits almost instantaneous roentgenograms. Needles are placed in the kidney tissue to act as markers for any fragment which may be present. His experience has been over a period of five years in more than fifty complicated cases of calculus disease. The intensifying screen is made use of in all cases of complicated and multiple calculi.

DAVIS H. PARDOLL, M.D.

Anaphylactic State after the Injection of Abrodil (Skiodan). Hans Horsters. *Med. Klinik*, Feb. 6, 1931, XXVII, 203.

Abrodil (known as skiodan in the U. S. A.), used for intravenous pyelography, is supposed to be non-toxic and contra-indicated only in severe insufficiencies of excretion of the kidneys. A case is described in which, after intravenous injection of this drug, a severe state of anaphylactic shock took place. The patient had a bronchitis of apparently allergic character (eosinophilia in the sputum and blood). A primary toxic action of the skiodan could be excluded, and the occurrence of this alarming sequence (cyanosis, vomiting, unconsciousness for about five hours) can best be explained by an anaphylactic reaction of the patient, who had had several intravenous injections of sodium iodide some weeks before.

H. W. HEFKE, M.D.

Diagnosis in Urology: Roentgenologic Studies of the Urinary Tract, with Contrast Agents Administered Intravenously. Robert E. Cumming. *Jour. Michigan St. Med. Soc.*, December, 1930, XXIX, 881.

Having used the two successful chemical preparations as contrast agents in a series of 50 cases, it seems worth while to report the conclusions, which seem quite positive, and to call attention to several misconceptions which

are prevalent. In addition to the production of renal and ureteral fillings for urography, the method has been of value in the study of renal, pelvic, and ureteral dynamics. Those with extensive experience with uroselectan find that normal kidneys do not give as dense a contrast shadow as the retrograde method, and the dense outlines are obtained only when there is a slowing of the excretion. The 50 patients reported on include normal cases (12), renal tuberculosis (4), renal tumor (2), lithiasis (18), carcinoma of the bladder (1), reduplication of ureters and pelvis (2), acute pyelonephritis (2), prostate hypertrophy (2), and hydronephrosis (7). Of these 50 cases, 38 were proven out, as follows: Completely diagnosed (14), no data obtained (12), slight information (5), requiring retrograde urography for final decision (7). The cases in which the method gave no data included the four cases of renal tuberculosis, the two cases of renal tumor, the carcinoma of the bladder, the acute pyelonephritis, and the prostate obstruction.

W. W. WATKINS, M.D.

Solitary Serous Renal Cysts, with a Study of Roentgen Observations. Robert Herbst and William J. Vynalek. *Jour. Am. Med. Assn.*, Feb. 21, 1931, XCVI, 597.

Retention cysts of the kidney occur as solitary and multilocular cysts, and are frequently found by the pathologist. The clinician observes them less frequently because, in themselves, they produce no pain. Confusion apparently exists regarding pyelographic changes. Solitary cysts, regardless of the disputed theories of origin, involve the cortex.

Pyelographic observations will depend on the relationship of the cyst wall to the pelvis or its calices, to any changes produced in the course or lumen of the ureter by virtue of pressure from a large cyst, or to any change in the position of the kidney from pressure or increased weight. The most common characteristics of roentgen observations have been summarized in tracings made of pyelogram illustrating the representative groups. These are six in number: (1) Normal: (2) hydro-

nephrosis; (3) compression of the calix or the true pelvis; (4) change in position and axis of the kidney; (5) the outline of the shadow of the cyst, and (6) calcification of the cyst wall.

Ormond made pyelograms before and after applying downward pressure on the tumor with the hand. Associating the mass of lesser density with the kidney proper enabled him to make a correct pre-operative diagnosis.

With compression seen in the pyelogram, kidney involvement should be suspected though it may not be interpreted correctly. If the outline of the cyst is seen near or overlying the kidney, a pre-operative diagnosis can often be made. Six cases are discussed in detail.

CHARLES G. SUTHERLAND, M.B.

Uroselectan in Urinary Tuberculosis. Oswald S. Lowsley. *Jour. Urology*, March, 1931, XXV, 293.

In a series of 45 cases, the author found uroselectan to be of wonderful assistance, particularly so in tuberculosis of the urinary tract. There is an absence of permanent ill effects; temporary discomforts are negligible; the existing symptoms are not accentuated, and cases which are symptomless remain so following the intravenous injection.

An average of forty-nine minutes was found to result, employing uroselectan, in the best urograms in cases of renal tuberculosis. Individual cases took from five minutes to three hours to render satisfactory visualization. The utilization of this method in children eliminates general anesthesia. Delay of visualization, excavation of the kidney cortex, and granular encroachment on the lumen of the kidney pelvis and ureter may be demonstrated. Painful instrumentation of tuberculous bladders are rendered unnecessary; the degree of tuberculous involvement may be estimated, and a satisfactory urogram may be obtained in cases in which ureteral catheterization is either impossible or difficult by the use of intravenous urography.

In cases of bilateral tuberculosis, in which it was deemed advisable to remove the most impaired kidney, function of the remaining

organ may be estimated and information of considerable value secured by this method. In cases in which the general condition of the patient contra-indicates any investigation as rigorous as cystoscopy, uroselectan may be employed to advantage. In the differential diagnosis of stone in a renal calyx, calcified renal cortical abscess, and extra-renal shadow, this method is extremely helpful for the renal cortex is accentuated by the intravenous injection.

While the urograms by the intravenous method are not as clearly defined as those obtained on retrograde injection, the many advantages of the former, particularly in which cystoscopy and ureteric catheterization are impossible or dangerous, assert its vast importance in the diagnosis of urologic conditions.

DAVIS H. PARDOLL, M.D.

GYNECOLOGY AND OBSTETRICS

Pregnancy after Radium Therapy for Cervical Carcinoma: Cesarean Hysterectomy at Eighth Month. G. B. Contardo. *Ann. di Ostet. e Ginec.*, January, 1931, LIII, 125.

The author reports a clinical case, that of a woman treated with radium for cervical carcinoma, who subsequently became pregnant. A cesarean hysterectomy was necessary at the eighth month. In his original article (presented at the Italian Congress of Obstetrics and Gynecology, December, 1930), he describes the anatomopathologic findings in the various segments of the uterus and ovaries, and the results of examination of the fetal organs.

Some Notes on the Value of X-rays in Pregnancy. H. R. Sear. *Med. Jour. Australia*, Jan. 31, 1931, I, 137.

Radiography is of service in regard to the measurement of the pelvis, the establishment of pregnancy, the presentation, and the diagnosis of multiple pregnancies. Deformities such as anencephaly, bone lesions such as fragilitas ossium, and the death of the fetus may be diagnosed. Shortly after the death, an overlapping of the cranial bones occurs, due to

the decrease in pressure of the cerebrospinal fluid, and this is well shown on the films. At the tenth or eleventh week the fetal bones are very apparent. The suggestion is made that extra-uterine pregnancies may perhaps be demonstrable at the eighth or ninth week.

Contrast media tests, by air, the Rubin test, and with lipiodol, may have application in establishing the patency of a tube or demonstrating the contour of the uterine cavity.

J. G. STEPHENS, M.B., D.M.R.E.

Results and Value of Roentgen Diagnosis in Obstetrics. K. Heim. *Med. Klinik*, Dec. 24, 1930, XXVI, 1917.

Only since technical difficulties have been surmounted, has the roentgen examination been able to be of assistance in obstetrics. The ventrodorsal films assist in showing a twin pregnancy, hydrocephalus, malformation of the fetus, and abnormal positions. After the fifth month a pregnancy can be shown if the X-ray apparatus is efficient. The antero-posterior film does not give any information concerning the relation between the head of the fetus and the pelvis of the mother. Only a lateral film of the pelvis gives valuable help. The technic used by the author is as follows: 105 K.V., 20 ma., 1.0 Al filter, and from 16 to 18 seconds. The filter is interposed in order to minimize an over-dose of the soft rays. Knowing the distance from the focus to the skin and from the symphysis it is easy to calculate the actual length of the conjugata vera. Checking these measurements on skeletons and during operation confirms the accuracy of this method, which varies only 1 to 2 mm. from the actual length. Determining the actual size of the head of the fetus, by means of a roentgen examination, is still not reliable.

H. W. HEFKE, M.D.

Work of the Gynecologic Department of the Istituto del Cancro, Milan, during its First Two Years of Activity. Giovanni Moglia. *Ann. di Ostet. e Ginec.*, January, 1931, LIII, 49-56.

This institution admitted 478 patients during the two years' time. Of these, 114 were

not treated, for various reasons. Thus 364 cases received some sort of treatment—actinotherapy alone, surgery alone, or a combination of the two; of these, 158 are still living without recurrence (46.8 per cent); 78 with recurrence (23.1 per cent); 101 are dead (29.9 per cent), and 27 lost sight of (7.4 per cent). Other tabulations are given showing results of actinotherapy alone, surgery alone, etc., in cases from Groups I to IV, of varied localization. A tabulation is also given showing the result in 51 Group IV cases given medical treatment (lead, etc.). The author believes these results are no worse than in the best of Italian and foreign clinics.

[*Abstractor's note:* The term "actinotherapy" is equivalent to "radiation" as used in the United States.]

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

A Study of the Right Cardiovascular Border. Pietro Perona and Gaetano Ottaviani. *Archivio di Radiologia*, November-December, 1930, VI, 1079.

The authors studied the right border of the heart shadow by means of radiographs of patients and of injected specimens. They discuss and classify in this paper the factors that influence the outline of the heart and great vessels.

E. T. LEDDY, M.D.

Syphilis of the Aorta and Heart: A Clinical Study. Samuel S. Riven and J. Feigenbaum. *Canadian Med. Assn. Jour.*, November, 1930, XXIII, 656.

This article presents a summary of the clinical findings in a series of 74 patients with syphilitic cardiovascular disease, observed at the University Hospital, Ann Arbor, between July, 1925, and July, 1927.

The teleoroentgenogram or physical examination showed definite cardiac enlargement in 61, or 83 per cent, of the patients. The characteristic murmur of aortic insufficiency at the second right costal cartilage or along the left border of the sternum was heard in 42, or 56

per cent, of the cases. In 35 of these 42 cases, enlargement of the heart was found, both by physical and roentgenologic examination.

Other characteristic appearances of the roentgenogram in syphilitic aortitis are those described by Longcope and Hickey. In 1913, Longcope called attention to dilatation of the great vessels in syphilitic aortitis. He noted that the dilatation may take the form on the X-ray film of a cone with its apex pointing toward or away from the heart. He also pointed out that in the early cases there may be nothing more than a slight bulging shadow to the right of the vertebral column, in the region of the ascending aorta. He further maintained that with the extension of the syphilitic process to the transverse and descending segments of the aorta, the aortic knob disappears.

Hickey described a new sign frequently seen in aortic syphilis. There occurs, on the lateral roentgenogram, an angulation at the junction of the ascending and transverse parts of the aorta, which is a result of the lengthening of this vessel. There is also an increased visibility of the arch of the aorta in this projection. One of the most important fluoroscopic signs is expansile pulsation of the enlarged aorta, which is the earliest sign of aneurysm. There is nothing specially characteristic of the syphilitic heart itself on the roentgenogram.

L. J. CARTER, M.D.

Electrocardiographic Changes in Pneumonia. A. M. Master and A. Romanoff. *Proc. Soc. Exper. Biol. and Med.*, December, 1930, XXVIII, 266.

The authors made electrocardiographic studies daily on 21 patients with lobar pneumonia and 5 patients with bronchopneumonia to determine whether there was any graphic evidence of myocardial involvement during the disease. These patients were young adults and received no digitalis at any time.

They found increased P-R intervals, with T-wave inversions similar to those found in rheumatic fever, and also T-wave and R-T abnormalities similar to the changes seen in patients with acute coronary artery closure.

J. N. ANÉ, M.D.

Hydropneumopericardium: Report of a Case, with a Summary of the Literature. Richard T. Shackelford. *Jour. Am. Med. Assn.*, Jan. 17, 1931, XCVI, 187.

Cases of hydropneumopericardium are of rare occurrence. A search of the literature over a hundred-year period revealed a total of seventy-six cases. Schrotter stated he never saw a case in thirty-five years at the City Hospital, Vienna, nor did his predecessor Skoda.

Tabulation of the reported cases showed that 58 per cent resulted from some disease process within the body, the remaining 42 per cent being caused by some external agent. The third most common cause was attempted therapy which accidentally admitted air into the pericardium. The roentgenogram was usually characteristic. It showed the heart shadow, with fluid in the pericardium, and the pericardium itself represented as a thin line separated from the heart by an area of lessened density, which was the air or gas.

In the case reported by the author, the roentgenographic evidence was lacking. The cases reported are divided into four general groups: first, those in which there is no opening into the pericardium. These in turn were subdivided into those caused by direct or indirect trauma and those apparently due to some metastatic infection from similar processes elsewhere in the body. In the second group there has been a perforation into the pericardium from without. One subdivision contains those occurring as the result of trauma from violence or at thoracentesis, artificial pneumothorax, or paracentesis. The swallowing of foreign bodies that perforated the esophagus and formed a communication with the pericardium caused three cases, all fatal. The second subdivision were due to direct extension of benign or malignant suppurative lesions. The third group, in which the process originated within the pericardium and perforated outward, comprised three cases; in two, a purulent pericarditis ruptured into the lung or bronchus and the other ruptured through the anterior chest wall. The fourth group, those in which the intactness of the sac could not be determined, contained one

traumatic case and six that began with pericarditis and terminated in recovery.

The physical signs establish the diagnosis. Percussion gives one of the two most characteristic and constant signs. This is a high pitched, tympanitic note over the precordium, with the patient in a recumbent position. The tympanitic area shifts with change in posture, as the air in the pericardium always remains above the fluid. Auscultation gives the second sign of importance and one that is pathognomonic of the condition. This is the loud, metallic, splashing sound of water being flipped in a closed cavity containing air, the "bruit de moulin" of Bricheteau. It is synchronous with the heart sounds and is usually quite loud. In a few cases the heart sounds disappeared entirely when the patient was placed on his back, to reappear with a loud splash when an upright position was resumed. The treatment has been entirely symptomatic and palliative. Huchard recommended tapping the pericardium if it became too greatly distended, but in none of the cases was this attempted.

CHARLES G. SUTHERLAND, M.B.

HODGKIN'S DISEASE (DIAGNOSIS)

Lymphogranulomatosis of the Vertebral Column. Walter Kuckuck. *Röntgenpraxis*, Feb. 15, 1931, III, 190.

The roentgenologic findings of a case with generalized Hodgkin's disease are described. The first lumbar vertebra was very dense. A myelogram showed a stop in the same region. Clinically, there were compression symptoms. These findings were proved by autopsy to be lymphogranulomatous changes. Roentgen irradiation did not influence the process.

H. W. HEFKE, M.D.

Study of the Morphogenesis of the Cells of Sternberg in Hodgkin's Disease. Luigi Villa. *Revue Belge des Sciences Médicales*, July-August, 1929, I, 593.

Studies of biopsy specimens in Hodgkin's disease, using a similar staining technic as for blood (May-Grünwald-Giemsa stains), allow

an accurate histologic identification of the cells and their morphologic characteristics. A minute biopsy fragment is pressed flat between two glass microscopic slides, fixed, and stained as for blood studies. Sternberg's cells are derived from cells of the reticulum found in isolated nests, never rising from megakaryocytes.

This article has colored illustrations showing the transitional stages.

CHARLES S. CAPP, M.D.

HODGKIN'S DISEASE (THERAPY)

Lymphoma Malignum (Hodgkin's Disease) and Lymphosarcoma: Pathogenesis, Radiotherapy, and Prognosis. Isaac Levin. *Jour. Am. Med. Assn.*, Feb. 7, 1931, **XCVI**, 421.

Through years of parallel study of lymphoma malignum and lymphosarcoma, on the one hand, and of all clinical types of carcinoma and sarcoma on the other, the author has gained the conviction that lymphoma malignum (Hodgkin's disease) and lymphosarcoma are nearly identical in their clinical manifestations. Also, that they both represent a special type of malignancy, and that the peculiarities in structure and clinical manifestations of lymphoma malignum (Hodgkin's disease), as compared with other types of malignancy, depend not so much on the difference in the causation as on the special character of the structure and function of lymphoid tissue.

Morphologically, Hodgkin's disease resembles an inflammatory granuloma rather than a malignant tumor. The clinical course sets it apart from any known parasitic or inflammatory disease.

Both lymphosarcoma and malignant lymphoma begin as purely local conditions in one lymph node. In this lymph node, either the lymphocytes or the reticulum cells or both acquire the characteristics of a cancer cell. Since these cells are very mobile they are immediately transported into other regions throughout the organism. It is possible to con-

ceive further that these transported lymphoid tissue cells find proper medium for their multiplication and development only within the lymphoid tissue of other regions or organs (lymph nodes, spleen, bone marrow), and in these regions the secondary metastatic tumors develop.

Both lymphoma malignum and lymphosarcoma frequently show tumors in parenchymatous organs which resemble in every particular metastatic tumors of carcinoma and sarcoma. Lymphocytes circulating in the blood are most readily influenced by radium and roentgen rays, while all the other normal types of leukocytes and the erythrocytes possess a greater resistance. Normal lymphoid tissue is much less radiosensitive than the various types of hyperplasias of lymphoid tissues. Simple inflammatory hyperplasias are less radiosensitive than the neoplastic hyperplasias. The lymphoid tumors of lymphoma malignum and lymphosarcoma represent the most radiosensitive of any tissue in plants or animals. The prompt beneficial therapeutic action of radiotherapy on lymphoma malignum is the best proof that biologically it is a neoplastic condition and more akin to lymphosarcoma than to an infectious lymphoma.

A series of cases are reviewed to illustrate the clinical course and therapeutic results.

CHARLES G. SUTHERLAND, M.B.

Hodgkin's Disease, with Special Reference to Diagnostic Difficulties, and Results Following Roentgen Irradiation: Report of a Case. George A. Sherman. *Jour. Michigan St. Med. Soc.*, December, 1930, **XXIX**, 909.

Hodgkin's disease may have a very insidious onset. Years may elapse before the lymph nodes become involved, and during this time, fever, loss of weight, loss of strength, anemia, pigmentation of the skin, and pruritus may be marked. Primary involvement may be in the mediastinal nodes. Since X-ray therapy is the only form of treatment universally accepted as beneficial, the tendency is to refer the patient at once to a roentgen therapist. However, there are certain periods in the illness when the patient must be carefully

treated. According to Kruchen, patients in the chronic stage, with hyperplastic granular tissue in nodes, with leukocyte count slightly increased or normal, with lymphocytosis, should have the diseased glands energetically radiated. In the reactive or florid stage, with the glands showing typical lymphogranulomatous tissue, and with hyperleukocytosis and varying leukocyte count, radiation is more difficult, and must be guided by the temperature and the blood picture. During the stage of exhaustion and cachexia, therapy must be carried out with the greatest precaution, if given at all.

W. W. WATKINS, M.D.

LIGHT THERAPY

Quartz Lamp Irradiation with Reflector. A. Keuser. *Münch. med. Wchnschr.*, Jan. 23, 1931, LXXVIII, 144.

The author describes and illustrates a reflector devised by him for use in this form of irradiation. It reduces materially the period of time required for effective irradiation and also cuts down the amount of current needed.

Light Therapy and the General Practitioner. A. Laqueur. *Münch. med. Wchnschr.*, Jan. 23, 1931, LXXVII, 144-149.

The author herein describes briefly the various types and makes of lamps available for the general practitioner, pointing out the advantages and disadvantages. There is a discussion of indications and of specific effects in certain diseases.

The Screening Effect of the Upper Layer of the Epidermis to Light. Leopold Freund. *Strahlentherapie*, 1930, XXXVI, 721.

Miescher has published an article in a recent issue of *Strahlentherapie* (XXXV, 403), the results of his investigations concerning the absorption of light in the epidermis. He concludes that the thickness of the horny layer is the controlling factor for the susceptibility of ultra-violet rays.

Freund discusses this paper and shows that he, himself, in earlier publications (1901) came to the same conclusions.

ERNST A. POHLE, M.D., PH.D.

PHYSICAL THERAPY

Irradiation of Schoolchildren. Sir Leonard Hill and Alan R. Laurie. *Lancet*, Jan. 24, 1931, CCXX, 182.

Four areas of the town of Derby, England, were selected and a random group of a hundred children were taken from each area. Four groups were formed, twenty-five from each area, so that all groups were comparable as regards living conditions. The ages were between 9 and 12 years, and as the groups were formed by random sampling, any effect of age was minimized. The test extended over sixteen weeks, with a break of a fortnight at Christmas.

Group 1 were given radiation from a long flame tungsten-cored carbon arc twice weekly.

Group 2 were given one radiostol pellet at school daily. Each of these pellets had the dosage of Vitamin D equivalent to that in about 2 ounces of a good cod liver oil.

Group 3 were given daily a pellet of exactly similar appearance, but which contained no radiated ergosterol, and also attended, twice weekly, for exposure to an arc lamp light fitted with a glass screen. This group was put in to demonstrate the part, if any, that psychology played in the taking of pellets and the mere fact of undressing before a lamp.

Group 4 were controls, who had nothing done for them at all.

The children were examined before the test, and points noted in the individual chart in regard to height and weight, hair and skin abnormalities, the conjunctivæ, temperament, eating and sleeping habits, tonsils and adenoids, cervical and submaxillary glands, evidence of gross disease (such as tuberculous joints and rickets), liabilities to any particular disease, and conditions of heart and lungs. Six local practitioners took part in the examination, four of them observing the heart and lungs, and two others making the remainder

of the tests. A uniform method of recording was followed.

The treatments were then carried out and the children re-examined by the same doctors who had first gone over them, but who were purposely uninformed of the groups to which the children belonged. The test was, therefore, secret, and the doctors could not be influenced in favor of any particular treatment. Unfortunately, there were epidemics of various infectious diseases in the town during the sixteen weeks, which greatly curtailed the numbers included in the test, but the results were based on 250 cases. No deductions were drawn from the hair, skin, heart and lung, and dental examinations, the latter being made by the school dental surgeons.

(a) Weight—Average Gain in Weight in Pounds per Child

Group 1	2.42	Group 3	1.81
Group 2	2.17	Group 4	1.91

(b) Tonsil and Gland Group

Group	No.	Total
1	33	26 remain the same, 7 improve.
2	29	20 remain the same, 3 improve, 6 worse.
3	38	28 remain the same, none improve, 10 worse.
4	27	27 remain the same.

(c) Percentage Improvement in Groups 1 to 4

	(1)	(2)	(3)	(4)
Conjunctivæ	30	13	0	10
Eating and sleeping	57	45	17	7
Liability to winter complaints, colds, bronchitis	30	21	15	7

(d) Any improvement on any chart was marked with a plus, and the addition of these showed the groups to come out as follows:

Group 1	162	Group 3	70
Group 2	130	Group 4	30

(e) Percentage of children in each group who improved in any respect:

Group 1	80	Group 3	34
Group 2	47	Group 4	24

Apart from these statistical results, the following deductions may fairly be made: That marked improvements under any particular heading, or class of headings, are always shown in Groups 1 and 2, and not by a small margin that could be due to chance but by an appreciable one. That in no case do Groups 3 and 4 show better results than 1 and 2. That Group 1 always shows slightly better results than Group 2. That in no case in Groups 1 and 2 was there any retrogression in the health of the children, except in a single instance of glands, for which there was an underlying cause, untreated except by irradiation.

The cases which made the really spectacular improvements were in Group 1.

The only instances of grateful thanks by parents were in Group 1 (spontaneous thanks noted). The greatest effect on children seemed to be on their eating and sleeping habits. The improvement has been most marked, in the case of the ultra-violet ray treatment, in the very headings we should most expect it, and slight, or absent, in the gland group, where there are such underlying causes as tonsils, bad teeth, and lice. The period was too short to expect much change in temperament, but many parents reported the excellent effects of irradiation on "nervy" children, and that some children became "naughtier."

H. J. ULLMANN, M.D.

The Historical Background of Physiotherapy. By the Publication Committee of the Canadian Radiological Society. *Canadian Med. Assn. Jour.*, February, 1931, XXIV, 263.

This is the first of the series of articles to appear in the *Canadian Medical Journal*, contributed by the Canadian Radiological Society, which is now a regularly constituted Section of the Canadian Medical Association.

In an editorial in the February issue of the *Journal*, the Editors congratulate the Canadian Radiological Society on "its initiative in obtaining a series of articles written by experts dealing with the application of physics to treatment of disease. It is the intention to publish these monthly in the *Journal*, and such topics as the X-ray, radium, ultra-violet and infra-red rays, diathermy, galvanism, Faradism, sinusoidal currents, hydrotherapy, and massage will be considered. The various subjects are to be dealt with in a way that will, it is hoped, be helpful to the general practitioner. Many of the articles will be accompanied by comments from various authorities, so that each topic will constitute a veritable symposium, comprehensive and up-to-date. We have every confidence that these articles will prove valuable and will add to the attractiveness of our *Journal*."

This introductory paper reviews, in a brief way, the historical aspects of physiotherapy from the viewpoints of light therapy, hydrotherapy, and electrotherapy.

The blessings of sunlight were recognized 3,000 years ago when the first Pharaoh set up "Alton Ra," the Spirit of the Sun, as a god to be worshipped by the people. Throughout the early history of the Egyptians, Greeks, and Romans, literature very frequently refers to the treatment of disease by light, and in the writings of Hippocrates, Celsus, and Galen, the applications of these teachings are revealed.

To Newton must go the credit for first preparing the way for placing the subject of light on a scientific footing, and to Finsen the first application from a medical standpoint. Bernard, Rollier, and Sir Henry Gauvain did much to place light therapy among the greatest advances of modern therapy.

Hydrotherapy has been in vogue from the earliest times among Egyptians, Greeks, Romans, Persians, and Assyrians. To Priessnitz, of Silesia, a common peasant, must go the honor of popularizing hydrotherapy in Europe. To Winternitz, of Vienna, belongs the honor of thoroughly studying hydrotherapy and establishing for all time this art on a scientific basis.

Electrotherapy is not so modern as might be thought. Static electricity was described by Thales, of Miletus, in 600 B.C. In the reign of Queen Elizabeth, Dr. Gilbert wrote extensively regarding magnetism, and a half century later, the first static machine was made in Germany. About the middle of the eighteenth century, Galvani made his early discoveries, and in 1830, Faraday made his first faradic coil. In 1898, D'Arsonval revealed to the world the principle of the high frequency machine.

L. J. CARTER, M.D.

RADIUM

The Radium Treatment of Primary Carcinoma of the Breast. Geoffrey Keynes. *Edinburgh Med. Jour.* (Trans. of Medico-

chirurgical Soc. of Edinburgh), February, 1931, XXXVIII, 19.

The author describes his method of irradiation developed at St. Bartholomew's Hospital, in London, in which he employs radium interstitially, using long needles, 4.8 cm. in length, with a wall of platinum 0.6 mm. in thickness. The needles contain 3.0 milligrams of radium element each and are left in the tissues for seven days. They are introduced into the breast, along the pectoral fold, into the axilla, below and above the clavicle, and into the intercostal spaces near the sternum. Their introduction is under gas-oxygen anesthesia directly through the skin, an incision being unnecessary. The needles are placed in and about the primary growth, into metastatic glands, and along the courses of lymphatic drainage, as traced by Sampson Handley.

The advantages of irradiation in breast carcinoma are due to the selective action of irradiation on the carcinoma cells, the wide field which can be covered by irradiation, the absence of subsequent mutilation, and the satisfactory results obtained.

By this method of irradiation by radium employed interstitially the author has treated 138 primary carcinomas of the breast, of which 98 were operable and 40 were inoperable. Of the operable cases treated with radium, at least 45 have been free from any evidence of disease for periods up to three years. Of the 40 inoperable cases, 17 are alive and have been free from any evidence of disease for periods up to six years. These are gratifying results which compare favorably with other methods of treatment, although a greater number of cases and the lapse of years will be necessary to evaluate this technic definitely.

JACOB H. VASTINE, M.D.

Biological Effects of Gamma Rays. W. G. Whitman and M. A. Tuve. *Physical Rev.*, Feb. 1, 1931, XXXVII, 330.

M. A. Tuve, of the Department of Terrestrial Magnetism of the Carnegie Institute, one of the authors of the paper, "Experiments with High Voltage Tubes," which received the thousand dollar prize of the A.A.A.S., de-

scribes in a short note to the Editor of the *Physical Review*, some experiments on physiological effects of gamma rays which were carried out in co-operation with W. G. Whitman, of the Johns Hopkins University. Sixty-three white rats were radiated by 6 grams of radium, which was spread over a surface of 3×10 cm., and filtered through 1 mm. of platinum, 1 mm. of brass, 16 mm. of lead, and 5 mm. of celluloid. The distance from the radium to the surface of the animal was 41 millimeters. Sixteen rats were exposed to 2.5 grams of radium under the same conditions, but without the lead filter. Exposure times varied from one-half minute to 17 hours. All of the rats died which were exposed six hours or longer to the 6 grams of radium, due, partly, to injuries to the gastro-intestinal tract. The rats which were exposed for six hours also showed gastro-intestinal symptoms, but less severe, and died from one to three weeks later from a progressive anemia.

The lethal exposure for these radiation conditions seems to lie around four hours, and for the 2.5 grams of radium without the lead filter, around three hours. The blood counts of the 66 rats made before and 0, 1, 3, 7, 14, 21, and 35 days after exposure showed that the minimum exposure for an effect upon the blood count was about 20 minutes.

Breeding experiments are in progress to study the effect of various conditions upon sterility. Eastman extra-fast dental films were exposed to the radiation for various times, and the darkening was correlated with the lethal rat dose in order to arrive at some means of indicating the total exposure of workers with high voltage tubes (two million volts) in the authors' laboratory.

OTTO GLASSER, Ph.D.

RICKETS (THERAPY)

The Healing of Late Rickets Coincident with Low Serum Phosphate. Genevieve Stearns and Julian D. Boyd. *Proc. Soc. Exper. Biol. and Med.*, December, 1930, XXVIII, 243.

The authors studied the calcium and phosphorus metabolism of two white girls, 12 and

13 years of age, with clinical, roentgenologic, and chemical evidence of rickets. During the period of several winter months, when this work was undertaken, definite roentgenologic evidence of healing of the rachitic lesions was noted. While the amounts of calcium and phosphorus retained by each child were sufficient for bone formation, the serum inorganic phosphorus remained consistently low, ranging from 2 to 3.2 milligram per cent.

J. N. ANÉ, M.D.

Actinotherapy in Pediatrics. Gaston La Pierre. *Union Med. du Canada*, March, 1931, LX, 188-189.

The author reports a case and mentions a series of cases in which actinotherapy has been better than anything else (including calcium diet, etc.) in the treatment of rickets. It is truly specific in the treatment of the spasmophilic diathesis. Treatment of rickets by diet and medication may take years, but with actinotherapy the author has, in a few months, obtained definite functional and anatomic improvement and cure of the condition.

The Effect of Phosphorus in Rickets: I.—Roentgenologic Changes in Rickets Following Administration of Phosphorus. Edward L. Compere. *Am. Jour. Dis. Child.*, November, 1930, XL, 941.

The author attempts to interpret the roentgenologic evidence collected in the study of the long bones of 10 cases of severe infantile rickets, and an additional control case without rickets. The infants were studied at intervals of from three to six weeks. Roentgenograms were made of the knees, ankles, and wrists, and determinations were made of the calcium, inorganic phosphates, carbon dioxide, and hydrogen ion content of the blood serum. Some of the group received phosphorus alone; some received cod liver oil alone; some received phosphorus and cod liver oil from the beginning of treatment, and others were given cod liver oil or phosphorus after a period of medication, during which the other substance had failed to promote healing. The product of a well known phar-

maceutic house was supplied, and the dosage recommended by M. M. Eliot in 1925, was prescribed.

Phosphorus alone was not sufficient to bring about healing in severe cases of infantile rickets, although cod liver oil alone in sufficient doses brought about healing in most cases. Phosphorus and cod liver oil brought about prompt healing of rickets and increased calcification of the shafts of the bones. Patients receiving two one-hundredth grain pills of elementary phosphorus daily for several months, with roentgenologic evidence of improvement, showed slow-healing response on addition of cod liver oil—the healing was delayed but eventually occurred. The combination of cod liver oil and phosphorus produced more prompt and certain healing of rickets than did cod liver oil alone. Films illustrate the healing process.

F. B. MANDEVILLE, M.D.

ROENTGENOTHERAPY

The Place of X-rays in the Treatment of Malignant Disease, with Especial Reference to Cancer of the Breast. F. Hernaman-Johnson. *Practitioner*, February, 1931, CXXVI, 259.

The author asserts that X-ray treatment should be recognized as having a place in the treatment of cancer as important as that of surgery or radium. Regarding radium and X-ray, he quotes Douglas Quick as stating, "The two agents are complementary and not competitive . . . The majority of cancer cases require, in their total round of treatment, surgery, radium, and X-radiation. The more closely this is correlated the better."

In his plea for the wider use of X-radiation in malignant disease of the breast, the author quotes Pfahler as reporting 68 per cent alive and well after five years (Group I cases, including those with a freely movable growth and no affected glands, treated by the X-ray alone). The figure for corresponding cases treated by surgery alone is 28.8 per cent. Wintz claims 53 per cent alive and well after five years in more advanced patients following X-radiation. Lee reports 62 per cent free from disease after five years, following inter-

stitial radium treatment alone. Because of these data, the author questions the advisability of subjecting a patient with breast cancer to operation when there is every reason to believe that external treatment will accomplish results equally good.

The author advocates pre-operative irradiation, surgical removal of resistant remainders, and subsequent X-ray treatment at intervals over a prolonged period. Heavy localized doses of deep X-rays should be used at longer intervals on sites where occurrence is most likely—the axilla and the root of the neck.

J. M. MORA, M.D.

A Contribution to the Roentgen Treatment of Tuberculosis of the Male Genital Organs. J. Grünthal. *Röntgenpraxis*, March 1, 1931, III, 225.

The results of roentgenotherapy in cases of tuberculosis of the male genital organs are still disputed. It is apparent that the technic and the size of the dose are of considerable importance, if one reviews the literature. Twelve cases were treated by the author. From 5 to 10 per cent of an erythema dose was given, and altogether from 60 to 80 per cent was applied in the course of from one to three months. The pain and swelling decreased during the series of treatments, and wounds which would not heal after operation, closed quickly. It would be advisable, in the author's opinion, to try roentgenotherapy in such cases before resorting to surgery. The only disadvantage of this treatment is the fact that it takes considerable time.

H. W. HEFKE, M.D.

Studies of the Skin Tolerance with Protracted Roentgen Treatment. A. Kahlstorf. *Strahlentherapie*, 1930, XXXVIII, 499.

The skin tolerance in rabbits and man was studied following the exposure to a total of 4,200 r of heavily filtered roentgen rays (168 K.V., 3 ma., 1.3 mm. Cu + 1.0 mm. Al, half value layer in copper 1.1 mm.) applied according to the protracted fractional dose method. Fourteen times 300 r at 24-hour intervals, or five times 840 r at 3-day intervals, were given. From tests made on the dorsum

of rabbits, it appeared that no epilation results even though four times the epilation dose for a single exposure is applied, according to the protracted fractional method. The same holds true for the fractional dose method alone. It appears then that the increase of the skin tolerance is primarily due to the subdividing of the dose; the protraction is only of secondary importance. How this affects the probability of a late reaction is not known. Histologic studies on human skin following treatment, according to the protracted fractional method, with a total surface dose of from 5 to 6 erythema doses, revealed only small degrees of cell degeneration. Since, however, the effect of radiation on malignant tumors, if applied according to that method, is clinically the same as that of the single massive dose method, it offers several advantages. The normal tissue is not injured much and, at the same time, the influence on the malignant tumor can be maintained.

ERNST A. POHLE, M.D., Ph.D.

The X-ray Treatment of Fibromas of the Nasopharynx. Mario Lambranzi. *Archivio di Radiologia*, January-February, 1931, VII, 62.

The author reports a case of nasopharyngeal fibroma, in which the patient is clinically well three months after completion of X-ray treatment.

E. T. LEDDY, M.D.

Radiation Therapy of Polycythemia Vera. George T. Pack and Lloyd F. Craver. *Am. Jour. Med. Sci.*, November, 1930, CLXXX, 609.

In this article the authors have included a very complete classification of polycythemia vera, with a review of the literature and the results obtained following radiation therapy applied to the long bones of the skeleton. They state that the only type in which radiation is effective is polycythemia with splenomegaly.

Although Osler asserted that his patients had never been benefited by roentgen-ray treatments, the authors cite a large number of cases, beginning as early as 1907, which were

treated with roentgen rays and in which a marked reduction in the number of erythrocytes was observed. In some of these cases the erythrocytes remained comparatively normal for a year and one-half, or more.

The authors feel that the cause of the rise in the count is the hyperactivity of the blood-forming elements in the bone marrow, rather than a decrease in the destruction of the erythrocytes; hence the treatments of the long bones rather than treatment of the spleen. Radiation treatment, however, is only a palliative measure and is not capable of preventing the usual fatal termination of the disease.

ROE J. MAIER, M.D.

Radiotherapy for Inflammatory Conditions. Arthur U. Desjardins. *Jour. Am. Med. Assn.*, Feb. 7, 1931, XCVI, 401.

As in so many other phases of radiotherapy, the first knowledge of the possible value of irradiation in inflammatory conditions resulted from the observation of unexpected benefit following exposure, for diagnostic purposes, of parts of the body which were the seat of inflammatory lesions.

The influence of irradiation of such lesions, especially when treated during the stage of maximal leukocytic infiltration (before the stage of frank suppuration), has been demonstrated. A review of all the published reports shows that the majority of patients derive great and prompt benefit. Pain is relieved in about twenty-four hours. In a small percentage there may be a temporary increase in pain. The best results are obtained when lesions are treated early. The dose of roentgen ray required is small, usually a single exposure being sufficient. In cases which do not react promptly to the initial exposure, the treatment may have to be repeated once or twice at intervals, depending on the dose given. Irradiation during the suppurative stage is less effective, but often relieves pain and may shorten the course. A small percentage of cases do not appear to be influenced at all.

Among the inflammatory lesions included are furuncle, carbuncle, cellulitis and phlegmon, soft tissue abscesses, paranephric and

perinephric abscesses, peridental infection, acute adenitis, onychia and paronychia, orchitis, epididymitis, mastitis, suppurative frontal and maxillary sinusitis, and otitis media.

Irradiation has been found ineffective in acute osteomyelitis and in cryptogenic abscess. Treatment by roentgen rays may be invaluable in pneumonia. It is useless after organization of the pneumonic exudate; active, continued inflammation, with fever and toxemia, and tuberculosis are contra-indications. No pathologic process in the body responds quicker to the X-ray exposure than non-resolution following pneumonia.

Roentgen rays have a real and substantial effect on the lesions of trachoma. Erysipelas, when it does not complicate conditions such as diabetes or nephritis, often responds well to radiotherapy, particularly in adult patients, and when treatment is given early. Acute parotitis, complicating certain surgical operations, has responded to radium and roentgen rays. Relief from pain and rapidity of regression again are the salient features of irradiation. Doses ranging between 10 and 50 per cent of the erythema doses are preferable. Treatment should not be confined to the area visibly or palpably affected but should extend well beyond such limits and include an adjacent zone of normal territory.

All the clinical circumstances indicate that inflammatory lesions respond to irradiation in proportion to the degree of leukocytic infiltration, and that the rays act primarily by destroying the infiltrating cells.

CHARLES G. SUTHERLAND, M.B.

Minimum Requirements for Roentgenography. H. J. Ullmann. *California and Western Med.*, February, 1931, XXXIV, 73.

The author discusses the various factors in the administration of therapy. This paper is not so much for the experienced radiologist as for the use of the inexperienced, so that he will not over-treat. Ullmann discusses the quality of radiation and quantity factors, and gives a brief discussion of the determination of a skin unit for both filtered and unfiltered radiation.

FRANCIS B. SHELDON, M.D.

The Application of Radiology to the Practice of Pediatrics, with Indications and Contra-indications. Walter L. Mattick. *New York St. Jour. Med.*, Oct. 1, 1930, XXX, 1156.

This paper is confined to the application of therapy with high voltage X-ray and radium. Radiology should be the handmaid of surgery and not a rival method of treatment. In applying radiation to children, the treatment time must be as short as possible and all methods must be simplified in their essentials. Surface applications of radium are useful, and when high voltage X-ray is applied, the technic should be such as to deliver the dosage in the shortest time possible. Among the conditions discussed are: Angiomas, which usually respond to radium; enlarged thymus, which should be given at from 25 to 30 per cent erythema dose of high voltage X-ray, repeating in two weeks if necessary; lymphoblastomas; Hodgkin's disease, which will respond readily to gamma radiation or deep X-ray therapy equal to 80 per cent of the skin dose, the response being so prompt that it is diagnostic. In leukemias, smaller doses of radiation are necessary—from 30 to 50 per cent of the skin dose over the spleen or enlarged glands, repeated in accordance to the response in the blood counts. Tuberculous nodes respond to radiation in 90 per cent of the cases, although a medium voltage is better. In bone cysts and benign giant-cell sarcoma, radiation gives good results. In the osteogenic sarcoma, neither surgery nor radiation offers much, though radiation is gaining preference in the treatment of such tumors. Radiation is offering more and more in the treatment of tumors in children, as well as in adults.

W. W. WATKINS, M.D.

The Effect of X-rays upon the Retina. Wolfgang Hoffmann. *Ztschr. f. Augenheilk.*, February, 1931, LXXIII, 214-231.

The effect of X-rays upon the retina is discussed at considerable length on the basis of two cases, one concerning a boy, aged 8, and the other a woman, aged 71. The first signs of change were found in the ganglion

cells, which may suffer extensive changes while the other layers of the retina seem to be unaffected. The processes involved in this change and the appearance of the cells are described in detail. The retina also shows circulatory changes. In the cases under discussion the small arteries were constricted while the capillaries and veins were distended.

The course of the changes in the retina in point of time depends upon the size of the individual doses and their distribution as to time. The beginning of the changes is difficult to determine clinically. The author advances several theories as to the cause of the retinal changes. He disagrees with those who hold the proliferations of the intima responsible. He thinks that one cause lies in repetition of the dose and another in the presence of generous quantities of soft rays. Experiments were performed in rabbits in the hope of clearing up the matter, but no absolutely certain conclusions were reached. However, the author states, his cases showed that with repeated irradiation in large fields with short focal-skin distance, injuries to the retina may occur even if the rays are well filtered.

The Treatment of Diseases of the Tonsils with Roentgen Rays. J. Grünthal. *Röntgenpraxis*, March 1, 1931, III, 222-224.

The author highly recommends the roentgen treatment in fifty cases of recurrent tonsillitis. Three cases were treated in the acute stage, using from 10 to 15 per cent of the erythema dose on both sides of the neck, according to Holfelder's technic. The result was good. In subacute cases still having a temperature and pain, from 10 to 30 per cent of an erythema dose resulted in relief of pain and improvement. After the acute as well as sub-acute stage was passed, these patients were treated in the same manner as the chronic. From 30 to 40 per cent of the erythema dose was given and the treatment repeated after three or four weeks, with a 10 per cent higher dose. In the third series, from 50 to 70 per cent of the erythema dose was given. Not only the tonsils but also the lymphatic tissue of the pharynx

is included in the field of the rays. It is necessary to avoid irradiation of the parotis, as this may lead to disagreeable after-effects. A plain hypertrophy of the tonsils is no indication for irradiation and one must inform the patient that the tonsils are not removed by this procedure, but that recurrent attacks of tonsillitis may be prevented.

The author's conclusions are: All stages of tonsillitis are amenable to roentgen treatment. It shortens the duration in acute and sub-acute cases. In chronic and recurrent cases, irradiation is the treatment of choice. A series of treatment protects adults against recurrent tonsillitis. Children have recurrences more frequently. The roentgen treatment is much easier for the patient, especially for children.

H. W. HEFKE, M.D.

Results of Treatment in the Radiumhemmet in Stockholm: Comparison of Results with Those of Other Institutes. Franz Melchart. *Wien. med. Wchnschr.*, Feb. 14, 1931, LXXXI, 222-227.

The author gives statistics on the percentage of cases treated with surgery, irradiation, and combined therapy. It was found that in carcinoma irradiation therapy produced primary recovery in 16.8 per cent, and five-year recovery in 10 per cent of all cases. This figure compares favorably with the results of surgical treatment during the same period. During the period from 1914 to 1921, a total of 543 cases of carcinoma of the uterine cervix was treated at Radiumhemmet. Among this number were many which were far advanced, since the group showed an operability of only 29.1 per cent. For the entire group, the recovery percentage was equal to 20.7, while for the operable cases (145), there was a recovery percentage of 46.2. These figures compare very favorably with those of Voltz in Munich, and Lacassagne in Paris.

With regard to primary mortality, Radiumhemmet also shows good results. A group of 543 cases treated with irradiation showed a primary mortality of 1.59 per cent, as compared with 17.2 per cent mortality in 3,257

cases upon which operation was done. In carcinoma of the body of the uterus, the end-results of irradiation were practically the same as those of surgical treatment. In cancer of the breast, a combination of operation and irradiation was found most effective. With this combined therapy, the end-results were as follows: Group I (Steinthal), 70 per cent recovery in 12 per cent of 162 cases; Group II, 33 per cent recovery in 62 per cent of 162 cases, and Group III, 12 per cent recovery in 26 per cent of 162 cases. According to statistics collected from the literature, the recovery is as follows: Group I, 75 per cent; Group II, 28 per cent, and Group III, 7 per cent. The results of the Radiumhemmet compare very favorably, therefore, with statistics in the literature. In carcinoma of the mouth, the Radiumhemmet (1916 to 1921) obtained 34 per cent recovery in 135 cases by irradiation, as compared with 31 per cent in 64 cases upon which operation was done. With regard to metastases, the Radiumhemmet statistics were much more favorable than those of other clinics (35 per cent as compared with 46 to 76 per cent). Carcinoma buccæ, because of the danger of necrosis of the mandible, is treated in the Radiumhemmet with electroendothermy and radium at a distance. The result, according to Melchart's figures, is 68 per cent primary freedom from symptoms, and 26 per cent actual recovery (five-year). In carcinoma of the skin (face) and lip, there was recovery in 86.3 per cent of 102 superficial cases, and in 51.4 per cent of 105 infiltrated tumors.

In sarcoma, the Radiumhemmet obtained recovery in approximately 30 per cent of the cases, a figure practically the same as given by Kienböck, Holfelder, and Seitz and Wintz. This percentage was achieved in 543 cases treated between the years 1910 and 1922. Of this number, 492 were treated with irradiation only, and showed a recovery of 24 per cent in primary cases, and 18 per cent in post-operative recurrences. The rest, treated with a combination of irradiation and surgery, yielded 63 per cent, a total recovery, then, of 33 per cent. Operative therapy alone brought recovery in 30 per cent.

Statistics are given concerning the incidence of malignant tumors in Sweden, as compared with Austria, and a computation of the hospital space required for accommodating all of the cases which are likely to occur within the area to be served by the hospital.

An Evaluation of Modern Roentgen Therapy. R. E. Loucks and B. R. Dickson. *Jour. Michigan St. Med. Soc.*, November, 1930, XXIX, 764.

Surgery, radium, and the X-ray are no longer to be regarded as rivals but as synergists. In almost any malignancy, the X-ray is the most available, inexpensive, and practically effective method for attacking and preventing metastases and extension of a malignancy. This radiation may be either pre-operative, or post-operative, or both. In the field of toxic goiter, irradiation is becoming more firmly established each passing year. The type of case not controlled by radiation is usually identical with the type requiring several operations. In myomas and metropathies, the X-ray is so valuable that if it were limited to that field alone it would be extremely useful. Fibroids in women over forty, with malignancy excluded, are the suitable cases. Adnexal inflammation is no longer considered a contra-indication. Radiation in inflammatory conditions is a rapidly expanding field. Pordes thinks the beneficial effect is due to the destructive effect on the white cells in the inflammatory tissue, accelerating the process of repair. The inflammatory lesions amenable to radiation which may be mentioned are boils, carbuncles, lymphangitis, erysipelas, adnexal disease, whooping cough, etc.

W. W. WATKINS, M.D.

The Application of and the Indications for Soft Roentgen Rays. Alexander Böhm. *Strahlentherapie*, 1930, XXXVIII, 341.

Beginning in March, 1929, the author has treated within a year, over 500 cases with roentgen rays of long wave length (9 K.V.). The technic is discussed first, with a detailed description of the arrangement of several fields side by side on the skin, avoiding over-

lapping. Two hundred and two patients with eczema were treated with from 200 to 350 r. The results did not differ from those obtained with ordinary roentgen rays. After the tube had been used for about 60 hours, the output dropped apparently so as to necessitate two or three series of treatments. Fifty-five cases of dysidrosis were treated with from 250 to 350 r, with temporary improvement in all cases. Fifty-nine cases of neuroderma (250 to 400 r) responded very well. Forty-five cases of psoriasis and one case of parapsoriasis responded to from 300 to 400 r more quickly than to ordinary roentgen rays. The recurrences, however, appeared soon after the temporary cures. Seventy-four cases of alopecia areata or seborrhoica were treated with from 150 to 200 r, giving a total of not more than three treatments. Some cases, even of several years' duration, responded well. Ten cases of pruritus ani and vulvæ responded, but the effect of the ordinary roentgen rays seemed to be better. Eight cases of lupus vulgaris did not respond well. Fourteen cases of erythema induratum Bazin were improved. Two cases of sarcoid Boeck and two cases of sarcoid Kaposi showed improvement following the second treatment. Five cases of verruca vulgaris were treated with from 500 to 700 r without success. Seven cases of juvenile verruca responded better. Four cases of nevus flammeus in adults did not respond following exposure to three erythema doses. Twenty superficial basal epitheliomas responded to from 800 to 900 r, repeated three times every three weeks. Three cases of carcinoma on the basis of xeroderma pigmentosum, and one case of melanosarcoma showed no improvement. Three cases of poikiloderma and two cases of pityriasis versicolor were improved, while some cases of vitiligo, acne, folliculitis, rosacea, and lichen did not respond. Twenty-five cases of epithelioma, eczema, psoriasis, and pernio, which had been treated by ordinary roentgen rays before, could not be influenced by the softer radiation. In some patients, particularly those suffering from eczema, a dark brown pigmentation was observed, lasting for months, following exposure to 150 r. In the

majority of cases, such a pigmentation appeared only following the application of an erythema dose.

The author has not seen any late reactions in his patients, because he has used all the precautions customary in roentgen therapy, with ordinary roentgen rays.

ERNST A. POHLE, M.D., Ph.D.

Results of Roentgenotherapy of Surgical Tuberculous Diseases. Josef Palugyay. Wiener klin. Wchnschr., Jan. 16, 1931, XLIV, 85.

Good results can be obtained by roentgenotherapy in many cases of surgical tuberculosis. In most cases of tuberculosis of the lymphatic glands, this treatment results in a clinical cure. Recurrences are seen less frequently than after surgery. In tuberculosis of the joints, bones, and tendons it is of value only in conjunction with orthopedic means. In roentgenotherapy of these cases one must be especially careful.

Tuberculous peritonitis may be treated successfully if one deals with the plastic type. A tuberculosis of the genital organs can be benefited considerably by small doses of irradiation, and may sometimes be cured without surgery. Of 97 cases of tuberculosis of the lymphatic glands, 100 per cent could be cured clinically and 94 per cent had no recurrence after three years. Of 51 cases of tuberculosis of the joints, 88 per cent could be cured clinically, with a function of from 75 to 100 per cent. Of 66 cases of tuberculosis of the male genital organs, 74 per cent could be cured and 62 per cent showed no recurrence in three years. Too intensive irradiation in such cases leads to worse results.

H. W. HEFKE, M.D.

SINUSES (DIAGNOSIS)

The Relation of Sinus Disease to Pulmonary Infection, from the Standpoint of the Roentgenologist. Willis F. Manges. West Virginia Med. Jour., October, 1930, XXVI, 588.

It is now generally admitted that accessory nasal sinus disease is frequently responsible for lung pathology of one kind or another.

Although not all sinus infections produce definite lung infections, and not all chronic lung infections are due to sinus disease, they are to be viewed in the light of cause and effect, with sinus disease playing the causative part. Three types of lung infection are found in this connection: First, the general peribronchial thickening from chronic bronchitis; second, glandular enlargement at the hilum, with bronchial irritation; third, localized infections in the lower lobes, leading to bronchiectasis and diaphragmatic adhesions. In the diagnosis of these three types, roentgenology ranks first in importance. There are more technical difficulties in examining the accessory sinuses, which are due to a variation in the size and thickness of skull bones, variation in the shape of the skull, and to the X-ray technic. These difficulties can be overcome if care is taken to re-examine when the first films are not up to standard in excellence. Most mistakes in interpretation are with relation to the antra, and stereoscopic films can frequently obviate these. A re-examination should be made whenever the X-ray interpretation does not agree with the rhinologist's findings. While it is not so difficult to determine whether or not there is lung infection present, it is oftentimes difficult to say whether or not it is acute or chronic, and frequently this requires repeated examinations. Many cases of sinus and lung infection are associated with asthma.

A number of authors are quoted, and a bibliography is appended.

W. W. WATKINS, M.D.

The Management of Chronic Sinus Disease. W. V. Mullin. *New York St. Jour. Med.*, Nov. 1, 1930, XXX, 1280.

Needless to say, every procedure that will aid in arriving at a diagnosis should be carried out. After the history and inspection, a well-taken and skilfully interpreted roentgenogram is of inestimable value. There has been much discussion as to the value of lipiodol. While it is frequently of great value, it is often employed unnecessarily, and if the time spent in preparing the patient and instill-

ing lipiodol were occupied in studying a well-taken film, with a roentgenologist skilled in this field of work, an equal amount of information would be obtained in the majority of cases.

W. W. WATKINS, M.D.

Use of Iodized Oil in Diagnosis of Nasal Sinus Conditions: Further Observations. Henry M. Goodyear. *Jour. Am. Med. Assn.*, Oct. 4, 1930, XCV, 1002.

In the search for forms of infection, it is not sufficient to report that the nose shows no evidence of polypi or pus. Too many important cases show a haziness in the roentgenograms and a negative lavage, and yet with opaque oils a definite filling defect is found which proves at operation to be a cystic membrane often dotted with small abscesses in its walls. These patients may be relieved by operation or saved from an unnecessary exploration of the sinuses. The type of operation may be more accurately determined.

Experience has convinced the author that the greatest value of opaque oils is in determining the condition of the antra. The increasing use of oils will be largely confined to the maxillary sinuses. Ethmoid and frontal sinus infections are more commonly secondary to an infection of the antrum than the serosa. One is more often determining the primary source. Roentgenograms of the course of the oil leaving the antrum suggest this conclusion. With the head in the recumbent position, it may be only a matter of minutes until the oil enters the ethmoid area and frontal sinus. The condition of the sphenoids can be more nearly determined by the use of the nasopharyngoscope. Opaque oils here find their greatest value in determining the position and extent of the cavity. The ethmoids offer a number of technical difficulties which have discouraged many workers. Iodized poppy seed oil, 40 per cent, diluted with two parts of heavy liquid petrolatum, has given most satisfactory results. Brominized sesame oil, full strength, is less viscous and, undoubtedly, has its advantage in displacement and insufflation methods, and in patients sensitive to iodine. Iodized oil is not used within a week, or pref-

erably ten days, after an irrigation. For the sphenoids, only one side should be injected—one side at a time—to prevent overlapping shadows.

CHARLES G. SUTHERLAND, M.B.

SKULL (DIAGNOSIS)

A New Syndrome: Hyperfunction of the Hypophysis in Childhood. C. I. Parhon and Constance Parhon-Stéfanescu. *Revue Belge des Sciences Médicales*, April, 1930, II, 336.

This is a case report of a young female, aged 16, whose chief complaint was nausea and headaches. Her menstrual history began at the age of 11, occurring regularly since then, every three weeks. At the age of 16, she was 4 feet, 6 inches tall and weighed 115 pounds. Physical measurements showed her to be perfectly developed as for a mature adult, with no evidence of acromegaly. The basal metabolism was normal.

Roentgenographic studies showed a normal sellar configuration, but of considerably augmented capacity. The epiphyseal lines were fused throughout the body. Considering the sustained precocious and frequent menstruation, the early bone and mature body development, and normal metabolism, the case was considered as due to childhood hyperfunction of the hypophysis.

CHARLES S. CAPP, M.D.

Indications and Contra-indications of Encephalography and Ventriculography. Eugene P. Pendergrass. *Jour. Am. Med. Assn.*, Feb. 7, 1931, XCVI, 408.

Dandy states that approximately 40 per cent of brain tumors can be localized by neurologic methods; assistance from routine roentgen examinations of the head may be expected in only 10 or 15 per cent of the cases. Frazier localized from 60 to 70 per cent by neurologic examinations without the aid of roentgen examination. In 65 cases of pituitary lesions, it was possible to make a correct clinical diagnosis in 55 cases, or 84.6 per cent. The roentgen diagnosis was accurate in 58 cases, or 90

per cent. Correlation of the clinical and roentgenographic observations raised the percentage of accurate diagnosis and localization to 64 cases, or 98.5 per cent. In 97 cases of cerebral tumor, 47.4 per cent were diagnosed clinically and 33 per cent were accurately localized. There was roentgen evidence of increased intracranial pressure in 55 cases, or 56.7 per cent; in 26 cases, or 26.8 per cent, the tumor was localized. In 59 cerebellar tumors, 48, or 81.4 per cent, were correctly localized by clinical examinations. The roentgen diagnosis was of localizing value in 30 cases, or 50.8 per cent.

Ventriculography is a procedure in which a series of properly exposed roentgenograms are made of the head in several positions in the horizontal posture within one hour following the removal of all the available cerebrospinal fluid from the ventricles of the brain and its replacement by air. In the presence of increased intracranial pressure, ventriculography is the procedure of choice in cases in which careful combined methods fail to demonstrate satisfactory localizing signs of the lesion. Patients who have unlocalized brain tumors or other lesions without increased intracranial pressure should not be subjected to ventriculography because of the high mortality associated with this procedure.

Encephalography is a procedure in which a series of properly exposed roentgenograms are made of the head in several positions in the erect posture within one hour following the removal of all the available cerebrospinal fluid and its replacement with air by the cisternal or lumbar route.

Indications for encephalography include symptoms in obscure cases, such as those incident to trauma, inflammation, senility, epilepsy, hemorrhage, tumors of the brain, hemiplegia, and birth injuries, or any condition of the brain or its surrounding structures that would distort or obliterate the subarachnoid fluid pathways.

The procedure is contra-indicated in all patients having a pressure of 20 mm. of mercury or more in the horizontal lateral position. Any obstruction of the ventricular system in the region of the third ventricle, aqueduct of

Sylvius, and the fourth ventricle will cause a considerable increase in intracranial pressure. Errors in technic carrying misinterpretations are discussed in detail, and the advantages of ventriculography and encephalography are tabulated.

CHARLES G. SUTHERLAND, M.B.

Cranial Radiography. Eng. Dufresne. *Union Med. du Canada*, March, 1931, LX, 169-175.

The unusual case which the author describes demonstrates that the X-ray may show lesions which do not exist, and that "the best radiologists cannot always interpret their own plates." A young man of 24 had been in a serious automobile accident November 21, 1920, and was hospitalized for fracture of both legs and scalp wound (no more enlightening information obtainable). He had since pursued a career marked by large forgeries, sexual perversion, and occupational instability. When the author saw him, March 7, 1927, both he and his parents insisted upon operation, on the evidence of two recent radiographs which obviously indicated marked thickening or depression of the internal surface, at the apex of the cranium. Previous removal of a bone splinter had opened the longitudinal sinus, but no adhesions were found when the author trephined. The latter operation also revealed *not the slightest thickening, depression, or calcareous deposit*; recovery by first intention. From then on the patient's conduct was entirely normal, and the author is still wondering how the removal of an apparently normal piece of bone could change a person's character. It could not have had a decompressive effect, as nothing was found indicating compression, and there is still no explanation of the fact that radiography showed a thickening of the cranium which did not exist. Two other radiologists have been consulted in the meantime, and neither can explain the situation.

Whether radiography shows things which do or do not exist is an important matter. If the patient recovers, the question is of purely scientific interest; but if he dies—and death has occurred after trephination—there may

be serious consequences for the surgeon. The author has frequent recourse to radiography, of course, but he simply wishes to call attention to a weak point which he hopes will be cleared up.

SPINE (DIAGNOSIS)

The Intervertebral Nucleus Pulposus: Its Anatomy, its Physiology, its Pathology. Jacques Calvé and Marcel Galland. *Jour. Bone and Joint Surg.*, July, 1930, XII, 555.

This article, intended to popularize the work of Schmorl and submitted for translation and publication in January, 1930, possesses genuine interest for all roentgenologists.

The intervertebral disc is described as a tough, fibrous capsule containing a nucleus of compressed embryonic notochord. In the normal adult spine the disc is biconvex and is firmly attached to the periphery of the concave articular surfaces of the vertebral bodies lying above and below it, the spongy, highly elastic nucleus acting as a spring to hold the bodies apart. As long as the bodies retain their protective coating of articular cartilage, they are able to withstand this pressure, in spite of the fact that the nucleus is small and, therefore, concentrates the full weight of trunk movements on an extremely small area. If there is injury to the articular cartilage, however, or if the disc becomes injured so that its ball-bearing action is lost, spine lesions are said to result.

Four diseases of the spine are described as directly related to the nucleus of the disc:

1. *Calcification of the Nucleus:* This is rare and probably of no clinical significance.

2. *Posterior Displacement of the Nucleus:* Cases are cited in which kyphosis is accompanied by paraplegia, and lipiodol injected into the subarachnoid space is said to have shown the nucleus of a disc extruded back into the spinal canal. The films of these cases, even with extensive re-touching, are not convincing.

3. *Spherical Discs and Vertebral Osteoporosis:* In general osteomalacia and certain cases of Paget's disease, the vertebral bodies,

being soft, collapse beneath the expansal pressure of normal discs which, accordingly, swell and assume a spherical shape. A local effect of this sort may occur at points in which the vertebræ are rendered soft by neoplasm.

4. *Intraspongy Nuclear Hernias*: If the articular cartilage of a vertebral body is injured by accident or disease, the nucleus of the adjacent disc may rupture through and dissect its way into the spongy bone of the vertebral body. These nuclear hernias are said to account for the central pits on the articular surfaces of vertebræ sometimes seen in roentgenograms of the spine.

PAUL C. HODGES, M.D.

Painful Hemisacralization of the Sixth Lumbar Vertebra. Ferdinando Talia. *Archivio di Radiologia*, January-February, 1931, VII, 56.

The author reports a case in which there was an actual increase in the lumbar segments, with hemisacralization on the right. He reviews various theories to explain the symptoms in patients with this trouble, and concludes that, as in the case described, the pain is due not to the increased number of segments but to hemisacralization which, with the proper anatomic relationships, produces pain.

E. T. LEDDY, M.D.

Primary Sarcoma of a Vertebra. Otto Rohrhirsch. *Röntgenpraxis*, March 1, 1931, III, 208.

The author reports a case of a primary sarcoma of a vertebra of a woman, 49 years of age, who complained of a severe backache following a trauma. A complete paralysis of the lower extremities and incontinence of the urine and stool developed gradually. The first roentgenogram showed a compression of the ninth dorsal vertebra, which was considered a fracture. Six weeks later the same vertebra was found to be completely compressed. On both sides, a soft tissue tumor could be seen, which was thought to be an abscess. The diagnosis of a tuberculous caries of the ninth dorsal vertebra was made. A laminectomy was done and the diagnosis of

spondylitis tuberculosa was maintained by the surgeon. The autopsy, however, showed a tumor which, on histological examination, proved to be a myelogenous sarcoma. This case proves that a tumor shadow is not only unilateral on the spine, as previously thought, but may be bilateral. Another symptom, the persistence of a normal intervertebral disk, was not given enough importance in the differential diagnosis.

H. W. HEFKE, M.D.

THYMUS (DIAGNOSIS)

The Possible Significance of the Thymus Gland in the Syndrome of Hyperthyroidism. Harry M. Margolis. *Ann. Int. Med.*, March, 1931, IV, 1112.

After reviewing the literature, the writer reports the results of the study of 85 cases of hyperthyroidism in which complete necropsy data were available. Fifty-five of these were diagnosed as exophthalmic goiter, and 30 as adenomatous goiter, with hyperthyroidism.

In 47 of the 55 cases, some degree of thymic hyperplasia was found, the gross weight of the thymus being increased in only 28. In 19 cases, hyperplasia only was evident when examined histologically. In 8 cases there was marked involution or the parenchyma was replaced by fibro-areolar connective tissue, which was either devoid of thymic cells or contained only small scattered thymic cells. Four of these cases showed definite increase in weight. It is obvious that the diagnosis of thymic hyperplasia must be based on both the gross and histologic studies.

The author presents photomicrographs and a detailed description and discussion of the contrasting reactions between the glands in exophthalmic goiter and in toxic adenomatous goiter.

He concludes as follows:

"The thymus gland frequently presents parenchymatous hyperplasia in hyperthyroidism. In general, the degree of hyperplasia is much more pronounced in cases of exophthalmic goiter than in cases of adenomatous

goiter with hyperthyroidism. Cortical hyperplasia is most common with exophthalmic goiter although medullary hyperplasia, alone or combined with cortical hyperplasia, also occurs. In hyperfunctioning adenomatous goiter, medullary hyperplasia is most characteristic. An increase in number and in the size of Hassall's corpuscles is nearly always seen in glands that show parenchymatous hyperplasia. True hyperplasia of the thymus gland may not be inferred from an increase in its gross weight alone. Histologic studies are essential to confirm such a diagnosis. The occurrence of hyperplasia of the thymus gland may represent the expression of a constitution indicative of an inherent predisposition to the development of hyperthyroidism. The degree of such hyperplasia may be roughly proportional to the degree of such susceptibility to the development of the disease. It is impossible at present to evaluate the direct physiologic relationship that may exist between the thymus and thyroid glands in the syndrome of hyperthyroidism."

CHARLES H. DEWITT, M.D.

The Thymus Problem to Date, Based on a Study of 475 Mediastinal Radiographs. John H. West. *Arch. Pediatrics*, November, 1930, XLVII, 671.

Using the criteria of Wasson, 35 enlarged mediastinal shadows were found in a study of the films of 475 infants and young children who had no symptoms referable to the thymus. The symptom probably most frequently associated with enlarged thymus is respiratory stridor in its various forms, but this alone is not conclusive. Other causes should be ruled out, such as mucus in the throat, mild inflammatory conditions, adenoids, tetany, retropharyngeal abscess, laryngeal stridor, and foreign body.

Thirty-three surgeons, with a total number of approximately 75,000 operations, were questioned regarding their experience. Thirty had never seen what they thought was a thymic death. One man had seen two deaths, with a large thymus found at autopsy. Two men had each seen one suspicious case.

The author concludes that routine X-ray examination pre-operatively is not indicated unless there are symptoms, and that there appear to be no definite indications for the X-ray treatment of any thymus in the absence of symptoms.

E. C. VOGT, M.D.

THYMUS (THERAPY)

Thymic Disorders: Their Recognition and Treatment, with a Report of Sixteen Cases. Ralph E. Pray. *Jour.-Lancet*, Nov. 1, 1930, L, 528.

The symptom most commonly recognized as due to thymic disorder is the intermittent cyanosis seen occasionally in the newborn. There can be no hard and fast rule as to any one type of child in whom to suspect thymic disorders. In the series of sixteen cases reported, the treatment was entirely by the X-ray. The aim of treatment was to free the patient from clinical symptoms, such as temporary cyanosis, dyspnea, croupy cough, choking, etc., and to try to secure a reduction in the size of the gland. The technic was: a field of 8×6 cm. in the center of the chest, from the suprasternal notch downward, 4 mm. Al filter, 30 per cent dose on the surface, repeated in from five to ten days. An equivalent radium treatment would be 100 mg.-min. of radium at 2 cm. distance from the skin, with 0.5 cm. silver and 1 mm. brass for 10 hours. The results from the treatment by the X-ray were entirely satisfactory.

W. W. WATKINS, M.D.

Pathological Thymus in Children from a Roentgenological Standpoint. W. H. Gilmore. *Illinois Med. Jour.*, August, 1930, LVIII, 97.

The author discusses the anatomy, physiology, and pathology of the thymus body. He makes films of the chest in the postero-anterior, antero-posterior, and lateral positions, the latter being necessary for the visualization of the trachea.

Gilmore takes the position that cases showing definite enlargement of the thymus on X-

ray examination should be treated, regardless of physical findings. The factors of treatment ranged from 50 P.K.V. upward, the time ranging from 1 to 4 minutes at a focal skin distance of 15 to 20 inches, with no filtration and 1 and 2 mm. of aluminum at intervals of from 5 days to one month. The present factors of the dosage are 100 P.K.V., 5 ma., focal skin distance 15 inches for 3½ minutes, with 2 mm. of aluminum as a filter. The dose is repeated every seven days for three sittings. The thyroid is protected, and follow-up films are made in 30 days.

Fifty-five patients were treated, as follows: 12 received 1 treatment; 3 received 2 treatments; 29 received 3 treatments; 6 received 4 treatments; 3 received 6 treatments; 2 received 8 treatments.

Of 20 cases followed up, 14 showed definite decrease in the size of the thymus, 4 showed no change in size, but satisfactory clinical improvement, and 2 were unaffected. In the 55 patients treated, 53 were relieved of their symptoms.

The conclusion reached is that X-ray therapy in small doses is almost specific.

C. H. DEWITT, M.D.

Enlargement of Thymus in the Newborn.
J. A. Johnston and Philip J. Howard. *Jour. Michigan St. Med. Soc.*, November, 1930, XXIX, 772.

Whenever we have an infant who presents noisy, difficult, or rapid breathing, we consider it necessary to rule out other causes before narrowing down to a diagnosis of thymic enlargement. Then, if there is an enlarged mediastinal shadow, we give two X-ray treatments, one week apart, or occasionally only five days apart, and watch the results. Our feeling is that thymic enlargement responds very quickly to X-ray therapy, and if there is not an immediate improvement after even one treatment, we begin to doubt the diagnosis. We particularly hesitate to continue the X-ray treatment beyond a maximum of four exposures of approximately 25 milliamperes-minutes each. From 42 to 50 per cent

of normal symptomless babies have an enlarged thymus according to the X-ray.

W. W. WATKINS, M.D.

THYROID (THERAPY)

The Value and Place of Radium in Treatment of Diseases of the Thyroid Gland.
Solomon Ginsburg. *Am. Jour. Roentgenol. and Rad. Ther.*, September, 1930, XXIV, 283.

In a series of 500 goiter patients studied the following five groups were encountered: (1) Diffuse non-toxic, or simple goiter; (2) nodular non-toxic, or simple adenomatous goiter; (3) nodular toxic, or toxic adenomatous goiter; (4) diffuse toxic, or exophthalmic goiter, and (5) malignant, or cancerous goiter. The diffuse non-toxic type was almost invariably found in juvenile patients only, none of whom were subjected to radium therapy, but were treated by general medical measures plus iodine medication, with gratifying results. In the remaining four groups of cases radium therapy was carried out by means of the radium "block" application, and the radium "collar" applicator, which are described and illustrated. The fractional dose method in the toxic cases was found to yield much more satisfactory results than the single massive dose.

The author cites 25 cases, with some photographic illustrations, which show the beneficial effects of radium therapy. Undue delay in the local treatment of toxic goiter is undesirable, and the importance of obtaining the patient's co-operation in order to achieve successful responses is demonstrated in the series presented. He concludes that radium and roentgen therapy efficiently employed have yielded results superior to operation in the treatment of both primary and metastatic thyroid cancer.

J. E. HABBE, M.D.

Results of Radiation Therapy in Toxic Goiter. P. Jaguttis. *Strahlentherapie*, 1930, XXXVIII, 557.

During the past three and one-half years, the author has observed 226 cases of toxic

goiter; 41 were men, 185 women. Twenty of these patients died, 16 were operated on, and 206 were treated by roentgen rays. Two of the patients operated on died and 9 of the 14 living were either cured or so much improved that they were capable of working. Of the 206 irradiated cases, 17 died; of the 189 living patients, 117 were either cured or so much improved that they could earn their own living. The percentage of good results in the cases operated on is, therefore, 64.3 per cent, and in the irradiated cases 65.36 per cent, if figured on the basis of the surviving patients. The technic is: Approximately 150 K.V., 0.5 mm. Cu + 2.0 mm. Al, and 23 cm. distance. Two fields were given over either lobe of the thyroid and one thymic field. The single dose over each area was 93 r, and a total of 279 r was applied during one series. This was repeated, if necessary, after from eight to twelve weeks. The evaluation of the various factors as weight, size of thyroid, eye symptoms, heart, nervous, and gastro-intestinal symptoms as well as the metabolism are discussed in their relation to the response of the patients to the treatment. The author believes that radiation therapy of toxic goiter is a valuable method and compares favorably with operation.

ERNST A. POHLE, M.D., Ph.D.

The Problem of Thyroid Intoxication. Roscoe R. Graham. *Canadian Med. Assn. Jour.*, September, 1930, XXIII, 349.

The significance of this paper, from the radiologist's standpoint, is the subordinate place given to the radiotherapy of hyperthyroidism. The only type in which the author will recognize the benefits of radiotherapy is the adolescent enlargement, with thyrotoxic symptoms, in a patient under 20 years of age. The author has not used radiotherapy in his practice, except in the above condition, doubtless for the very good reason that he believes "the administration of radiation should be controlled by an expert. . . . In frank thyroid intoxication, radical resection of the thyroid gland is the therapy of choice. . . . Iodine should never be

used in thyroid intoxication except during the pre- and post-operative management. It never cures hyperthyroidism."

L. J. CARTER, M.D.

The Causes of Success and Failure in X-ray Treatment of Basedow's Disease. P. Hesz and H. Schlecht. *Münch. med. Wchnschr.*, Jan. 9, 1931, LXXXVIII, 55-57.

This is a discussion of the problem of X-ray treatment *versus* surgery in Basedow's disease, in which the authors come to the conclusion that the two are of equal value and that good results can be obtained with the X-ray only if the doses are large enough and the period of treatment is of sufficient length. Because of the long period required for treatment, surgery would, in some cases, seem to be preferable, but the X-ray still has the advantage of a zero mortality.

TUBERCULOSIS (DIAGNOSIS)

The Etiology of Erythema Nodosum in Children: Its Relation to Early Tuberculous Infection. Lloyd B. Dickey. *Am. Jour. Med. Sci.*, October, 1930, CLXXX, 489.

According to the author, erythema nodosum in children bears a very close relation to early tuberculous infection, although the disease has a very low incidence in the first decade of life, most of the cases occurring at ages of from 10 to 30. He cites Faerber and Boddin, who reported 23 cases, in 21 of which the tuberculin reaction was positive. Robinson reported 3 cases living in the same house. Of 403 cases from the literature tested with tuberculin, 384, or 95.3 per cent, gave positive reactions. All of the patients under 7 years reacted positively. Various types of tuberculosis were found in this series, bronchial gland involvement being the most common.

A school epidemic reported by Wallgren involved 18 cases in a class of 32 children, all giving a positive von Pirquet reaction. A recently admitted child in this class had a well developed pulmonary tuberculosis. After the second month of this child's attendance, 17 children showed signs of the infection, 12

presenting erythema nodosum, and 6 having fever but no lung symptoms. Two months later, 13 showed evidence of pulmonary lymph-gland tuberculosis, and 4 presented suggestive lesions.

The author goes on to report 8 cases collected from the pediatric service of Stanford Medical School, all of which show an association of erythema nodosum with a tuberculous infection demonstrable in radiographs of the chest.

ROE J. MATER, M.D.

Non-apical Infiltrations in Pulmonary Tuberculosis. Karl Fischel. *Am. Rev. Tuberc.*, February, 1931, XXIII, 139.

This article is one in which every line carries so much information and food for thought that the abstractor is inclined to urge its entire repeated study rather than to attempt its condensation. To radiologists interested in the interpretation of chest films, it is especially interesting and very instructive.

We have here an explanation of why the radiologic findings are not in the apex, as found in the postmortem examination. The subapical infiltrates or bronchopneumonias, with clear apices, so commonly found in the clinically incipient cases, are accepted by the author as the first anatomical manifestation of tuberculosis, as taught by Ranke. The author stresses the short-sighted nature of physical examinations and explains the contradiction so often seen between the X-ray findings and physical examinations and histories. Reviewing Ranke's theory, the first involving bacillus is received by the body not as a specific infection but as is any irritant or foreign body, to be walled off in the formation of a tubercle within the lymphatic tissue, and a sensitization of all tissue cells.

The second stage begins with the next inoculation, followed by all the phenomena of inflammation: proliferation of tissue in the first instance and exudative processes in the latter. These exudative infiltrates form the anatomical densities so beautifully shown by the X-ray, even though not extensive enough to produce general symptoms. Ranke's second stage

is characterized by hypersensitiveness to bacilli and their proteins, inflammatory tissue changes, and metastases. The third stage is more one of anergy and chronic tuberculosis of the adult, with little systemic reaction.

Ranke's conception of the inflammatory character of all new foci is accepted by leading pathologists. Incipient apical tuberculosis is rare and is often secondary to other foci of infection. The early or incipient site is usually a bronchopneumonic infiltrate in the subapical area. The physical signs are vague or lacking, the onset so insidious and the symptoms so unobtrusive that a diagnosis without the X-ray is hardly possible. The early infiltrates may undergo retrogression with calcification. If the infection is extreme, caseation, softening, and cavity formation may be the sequence.

The author concludes as follows:

"(1) With pre-existing pulmonary tuberculosis, no matter of what stage, the formation of a new intrapulmonary focus cannot take place without local or general allergic symptoms.

"(2) The formation of a new focus is always accompanied by allergy two, although in exceptional cases the allergic symptoms may be so mild or of such short duration that they are not noticeable. Tertiary phthisis (in the sense of Ranke) is, therefore, not a new formation but a transformation of a secondary phthisis.

"(3) Exudative and proliferative phthisis are not principally two different types of pulmonary tuberculosis but the anatomical manifestations of two different allergic phases.

"(4) There is not any difference between pulmonary tuberculosis of the child and that of the adult."

S. C. BARROW, M.D.

The Value of the Roentgenologic Examination in Pulmonary Tuberculosis. Homer L. Sampson and Lawrason Brown. *Am. Jour. Roentgenol. and Rad. Ther.*, February, 1931, XXV, 209.

The authors' opinions are based on the study of 50,000 stereoscopic chest films made

on patients in the Trudeau Sanatorium at Saranac Lake, in many instances a single patient having been repeatedly studied over short intervals of time. By serial study one may often detect "spreads" prior to change of symptoms or physical findings, which fact emphasizes the importance of serial studies even in those patients who clinically appear to be doing well.

Concerning the reliability of the X-ray findings, the authors analyzed 1,367 cases diagnosed as pulmonary tuberculosis in 1,478 consecutive admissions to the Trudeau Sanatorium, and found that tubercle bacilli were present in 61.5 per cent; râles in 68.5 per cent, and the X-ray findings were positive in 99 per cent. At Trudeau, no patients having pulmonary cavities detectable by physical examination are admitted, yet 30 per cent of the

patients after admission on the X-ray examination show cavities. The extent of the lung involvement is almost always shown by the roentgen study to be more extensive than by the physical examination, the former method now being the accepted basis for classifying the extent of the lesion by the National Tuberculosis Association.

The authors believe that only very rarely will an individual who has reached the age of 25 or over, and shows negative chest X-ray findings, or, at most, only a peritruncal lesion, develop an active parenchymatous tuberculosis. Perhaps it is because of this belief that they strongly advocate the roentgenologic study of the chest for every high school graduate regardless of the past history, symptoms, or physical findings.

J. E. HABBE, M.D.

AUTHOR INDEX TO ABSTRACTS IN THIS ISSUE

- | | | | |
|--|------|--|------|
| ALBRECHT, E. The Standardization Apparatus of the Radiological Institute in the University of Freiburg..... | 973 | BEST, ELMER S. X-ray Negative Teeth..... | 992 |
| ALDEN, HERBERT S. (with JONES, JACK W.)..... | 979 | BLACKBERG, S. N. (with MENVILLE, LEON J., and ANÉ, J. N.)..... | 998 |
| ALEXANDER, JOHN, and BUCKINGHAM, WILLIAM W. Treatment of Non-tuberculous Suppurative Pneumonitis, Abscess, and Bronchiectasis..... | 991 | BLAINE, EDWARD S. Lunate Osteomalacia..... | 978 |
| ANDRÉN, GUNNAR. Birthmarks and Their Treatment..... | 932 | BLUMENSAAT, CARL. Hypertrophic Pneumic Osteoarthropathy (Pierre Marie)..... | 992 |
| ANDREWS, JUSTIN, and PAULSON, MOSES. The Effect of Barium Sulphate upon the Incidence of Human Intestinal Protozoa..... | 904 | BÖHM, ALEXANDER. The Application of and the Indications for Soft Roentgen Rays..... | 1021 |
| ANÉ, J. N. (with MENVILLE, LEON J., and BLACKBERG, S. N.)..... | 998 | BOINE, J. (with APPELMANS, R., and VAN GOIDSENHOVEN, F.)..... | 1000 |
| APPELMANS, R., VAN GOIDSENHOVEN, F., and BOINE, J. Contributions to the Study of Chronic Stenosis of the Duodenum..... | 1000 | BORMAN, C. (with CARLSON, H. A., DVORAK, H. J., LYNCH, F. W., and WANGENSTEEN, O. H.)..... | 995 |
| ARENDT, JULIAN. The Use of Diathermy in Diagnosis..... | 993 | BOYD, JULIAN D. (with STEARNS, GENEVIEVE)..... | 1016 |
| AUFSES, ARTHUR H. Skeletal Metastases from Carcinoma of the Rectum: Report of Eight Cases..... | 986 | BRAASCH, WILLIAM F. The Value of Uroselectan in Renal Lithiasis..... | 1004 |
| BAGNARESI, GIACOMO. Misplacements of the Cecum and Ascending Colon..... | 998 | Idem. Intravenous Urography..... | 1005 |
| BARNARD, LEONARD (with CARY, N. AUSTIN)..... | 978 | BROMER, RALPH S. The Chest in Rachitic Children: A Roentgenologic Study..... | 989 |
| BARTLETT, EDWIN I. The Treatment of Bone Tumors..... | 985 | BROWN, LAWRASON (with SAMPSON, HOMER L.)..... | 1030 |
| BECKER, J. The Technic of the Roentgenologic Demonstration of the Urinary Tract with Abrodil..... | 1003 | BROWN, SAMUEL, and REINECKE, HAROLD G. Roentgenological Study of the Superior and Posterior Mediastinum..... | 990 |
| BEER, EDWIN. Roentgenological Control of Exposed Kidneys in Operations for Nephrolithiasis, with the Use of Special Intensifying Cassette..... | 1007 | BRUNDSCHWIG, ALEXANDER. Primary Sarcoma of the Gall Bladder..... | 995 |
| BERG, HANS H. Roentgenologic Examination of the Colon..... | 999 | BUCKINGHAM, WILLIAM W. (with ALEXANDER, JOHN)..... | 991 |
| BERKHEISER, E. J., and SEDLER, FERDINAND. Non-traumatic Dislocations of the Atlanto-axial Joint..... | 980 | BUGREE, HENRY G., and MURPHY, ARTHUR J. The Value and Limitations of Uroselectan as an Aid in Urological Diagnosis..... | 1003 |
| | | CALVÉ, JACQUES, and GALLAND, MARCEL. The Intervertebral Nucleus Pulposus: Its Anatomy, its Physiology, its Pathology..... | 1025 |
| | | CANADIAN RADIOLOGICAL SOCIETY. The Historical Background of Physiotherapy..... | 1014 |
| | | CARLSON, H. A., DVORAK, H. J., LYNCH, F. W., BORMAN, C., and WANGENSTEEN, O. H. Value of X-ray Evidence of Bowel Obstruction in Various States of Intestinal Stasis..... | 995 |
| | | CARY, N. AUSTIN, and BARNARD, LEONARD. Kien- | |

böck's Disease: Compression Osteitis of Semilunar or Lunate Bone of the Wrist: Report of Cases.....	978	of Hopeless Roentgen and Radium Injuries	941
CASATI, ANNIBALE. Experimental Studies Concerning the Effect of Roentgen Rays on the Bone Marrow (Second Communication).....	994	GRÜNTAL, J. A Contribution to the Roentgen Treatment of Tuberculosis of the Male Genital Organs	1017
CASE, JAMES T. Comments on the X-ray Examination of the Appendix.....	974	Idem. The Treatment of Diseases of the Tonsils with Roentgen Rays.....	1020
CASTLETON, KENNETH B. (with PENDERGRASS, EUGENE P., and GILMAN, ROBERT L.).....	978	HARDING, D. B. Cholecystography: A Review of Thirty-four Cases, with Operative Findings	995
COMPÈRE, EDWARD L. The Effect of Phosphorus in Rickets: I.—Roentgenologic Changes in Rickets Following Administration of Phosphorus	1016	HASE, HERMANN, and KÜSTNER, HANS. Stem Radiation, Air Absorption, and Inverse Square Law	904
CONTARDO, G. B. Pregnancy after Radium Therapy for Cervical Carcinoma: Cesarean Hysterectomy at Eighth Month.....	1009	HEIM, K. Results and Value of Roentgen Diagnosis in Obstetrics.....	1009
CRAVER, LLOYD F. (with PACK, GEORGE T.).....	1018	HERBST, ROBERT H. Comparative Value of Uroselectan to Cystoscopic Pyelography.....	1004
CUMMING, ROBERT E. Diagnosis in Urology: Roentgenologic Studies of the Urinary Tract, with Contrast Agents Administered Intravenously	1007	HERBST, ROBERT, and VYNÁLEK, WILLIAM J. Solitary Serous Renal Cysts, with a Study of Roentgen Observations	1008
DESJARDINS, ARTHUR U. Radiotherapy for Inflammatory Conditions	1018	HERNANAN-JOHNSON, F. The Place of X-rays in the Treatment of Malignant Disease, with Especial Reference to Cancer of the Breast.....	1017
DICKEY, LLOYD B. The Etiology of Erythema Nodosum in Children: Its Relation to Early Tuberculous Infection	1029	HESZ, P., and SCHLECHT, H. The Causes of Success and Failure in X-ray Treatment of Basedow's Disease	1029
DICKSON, B. R. (with LOUCKS, R. E.).....	1021	HILL, SIR LEONARD, and LAURIE, ALAN R. Irradiation of School Children.....	1013
DUFRESNE, ENG. Cranial Radiography.....	1025	HOFFMANN, WOLFGANG. The Effect of X-rays upon the Retina.....	1019
DVORAK, H. J. (with CARLSON, H. A., LYNCH, F. W., BORMAN, C., and WANGENSTEEN, O. H.)	995	HORSTERS, HANS. Anaphylactic State after the Injection of Abrodil (Skiodan).....	1007
EDITORIAL (JOUR. AM. MED. ASSN.). A Year's Progress in Roentgenography of Abdominal Viscera	972	HOWARD, PHILIP J. (with JOHNSTON, J. A.).....	1028
EIKENBARY, C. F., and LE COQ, JOHN F. Osteomyelitis Variolosa: Report of Three Cases	977	HUNT, BARBARA. Treatment of Cancer of the Uterine Cervix and Breast by Radium and Deep Therapy X-ray, with Seven-, Five-, and Three-year End-results.....	987
FIGI, FREDERICK A. Early Diagnosis and Treatment of Malignant Conditions of the Mouth and Lips	985	HUNT, EDWARD L., and LISA, JAMES R. Peptic and Duodenal Ulcer in Tabes Dorsalis.....	997
FINDLEY, PALMER. Pelvic Irradiation in Cancer of the Cervix.....	987	JAGUTTIS, P. Results of Radiation Therapy in Toxic Goiter	1028
FISCHEL, KARL. Non-apical Infiltrations in Pulmonary Tuberculosis	1030	JOHNSTON, J. A., and HOWARD, PHILIP J. Enlargement of Thymus in the Newborn.....	1028
FOGELSON, SAMUEL J. The Treatment of Peptic Ulcer with Gastric Mucin: Preliminary Report	1001	JONES, JACK W., and ALDEN, HERBERT S. Maduromycotic Mycetoma (Madura Foot): Report of a Case Occurring in an American Negro	979
FOULDS, GORDON S. Observations on the Diagnosis and Treatment of Renal Calculi.....	1003	KAHLSTORF, A. Studies of the Skin Tolerance with Protracted Roentgen Treatment.....	1017
FREUND, LEOPOLD. The Screening Effect of the Upper Layer of the Epidermis to Light.....	1013	KEUSER, A. Quartz Lamp Irradiation with Reflector	1013
GALLAND, MARCEL (with CALVÉ, JACQUES).....	1025	KEY, J. ALBERT. Treatment of Fractures of the Head and Neck of the Radius.....	982
GATEWOOD. Subphrenic Abscess	972	KEYNES, GEOFFREY. The Radium Treatment of Primary Carcinoma of the Breast.....	1015
GILMAN, ROBERT L. (with PENDERGRASS, EUGENE P., and CASTLETON, KENNETH B.).....	978	KUCKUCK, WALTER. Lymphogranulomatosis of the Vertebral Column.....	1011
GILMORE, W. H. Pathological Thymus in Children from a Roentgenological Standpoint.....	1027	KURLANDER, JOSEPH J. Slipping of the Lower Femoral Epiphysis	981
GINSBURG, SOLOMON. The Value and Place of Radium in Treatment of Diseases of the Thyroid Gland	1028	KÜSTNER, HANS (with HASE, HERMANN).....	904
GLASER, MARK A. Campidol (Iodized Rapeseed Oil): Its Use in the Roentgenographic Visualization of the Body Cavities.....	992	LACASSAGNE, A. Indications for Radiotherapy in Sarcoma	985
GOLDHAFT, ARTHUR D., WRIGHT, LILLIE M., and PEMBERTON, RALPH. The Production of Hypertrophic Arthritis by Interference with the Blood Supply	975	LAMBRANZI, MARIO. The X-ray Treatment of Fibromas of the Nasopharynx.....	1018
GOODYEAR, HENRY M. Use of Iodized Oil in Diagnosis of Nasal Sinus Conditions: Further Observations	1023	LANE-CLAYTON, JANET. Cancer of the Lip, Tongue, and Skin: A Ministry of Health Report	987
GRAHAM, ROSCOE R. The Problem of Thyroid Intoxication	1029	LA PIERRE, GASTON. Actinotherapy in Pediatrics	1016
GRANINGER, KARL. Promising Ways to the Cure		LAQUEUR, A. Light Therapy and the General Practitioner	1013
		LARIMORE, JOSEPH W. Roentgenology of the Appendix	974
		LAURIE, ALAN R. (with HILL, SIR LEONARD).....	1013
		LE COQ, JOHN F. (with EIKENBARY, C. F.).....	977

- LEESER, F., and SIMSON, J. The So-called Endocrine Arthritis 975
- LEVIN, ISAAC. Lymphoma Malignum (Hodgkin's Disease) and Lymphosarcoma: Pathogenesis, Radiotherapy, and Prognosis.....1012
- VON LICHTENBERG, ALEXANDER. The Principles of Intravenous Urography.....1001
- LICHTY, JOHN A. The Present Consideration and Care of the Colon.....1000
- LISA, JAMES R. (with HUNT, EDWARD L.).....997
- LITTLE, CLARENCE C. The Present Status of the Cancer Problem 986
- LONG, WENDELL. The Rational Treatment of Carcinoma of the Cervix Uteri..... 987
- LOUCKS, R. E., and DICKSON, B. R. An Evaluation of Modern Roentgen Therapy.....1021
- LOWSLEY, OSWALD S. Uroselectan in Urinary Tuberculosis1008
- LÜDN, M., and WERTHEMANN, A. Changes in the Lungs Following Roentgen Exposure..... 990
- LYNCH, F. W. (with CARLSON, H. A., DVORAK, H. J., BORMAN, C., and WANGENSTEEN, O. H.) 995
- LYONS, CLINTON G. A Gastro-jejuno-colic Fistula, with a Barium Enema Entering the Esophagus 997
- MCCLLELAND, J. C. Uroselectan for Intravenous Pyelography1006
- MACGREGOR, R. R. Some Interesting Cases of Hypertrophic Pyloric Stenosis..... 999
- McKIM, L. H. Conservatism in the Treatment of Infective Bone Lesions of the Fingers..... 981
- MCLEAN, STAFFORD. I.—The Roentgenographic and Pathologic Aspects of Congenital Osseous Syphilis 984
- Idem. II.—The Correlation of the Roentgenographic and Pathologic Aspects of Congenital Osseous Syphilis, with Particular Reference to the First Months of Life..... 984
- MANGES, WILLIS F. The Relation of Sinus Disease to Pulmonary Infection, from the Standpoint of the Roentgenologist.....1022
- MARGOLIS, HARRY M. The Possible Significance of the Thymus Gland in the Syndrome of Hyperthyroidism1026
- MASTER, A. M., and ROMANOFF, A. Electrocardiographic Changes in Pneumonia.....1010
- MATTICK, WALTER L. The Application of Radiology to the Practice of Pediatrics, with Indications and Contra-indications.....1019
- MELCHART, FRANZ. Results of Treatment in the Radiumhemmet in Stockholm: Comparison of Results with Those of Other Institutes.....1020
- MENVILLE, LEON J., ANÉ, J. N., and BLACKBERG, S. N. Observation on the Motility of the Gastro-intestinal Tract of Starving Rats..... 998
- MEYER-BORSTEL, H. A Contribution to the Diagnosis of Early Carcinoma of the Pylorus 986
- MILLER, O. L. Acute Transient Epiphysitis of the Hip Joint..... 981
- MILLES, G., MÜLLER, E. F., and PETERSEN, W. F. New Technic for Roentgenographic Study of Renal Vessels.....1002
- Idem. Studies in Renal Denervation. I.—Roentgenographic Demonstration of Vascular Alteration1004
- MOGLIA, GIOVANNI. Work of the Gynecologic Department of the Istituto del Cancro, Milan, during its First Two Years of Activity1009
- MOORE, THOMAS D. Renal Carbuncle.....1005
- MORELLE, JEAN. Radiographic Studies on the Healing of Experimentally Produced Fractures Followed by Administration of Irradiated Ergosterol 982
- MÜLLER, E. F. (with MILLES, G., and PETERSEN, W. F.)1002, 1004
- MULLIN, W. V. The Management of Chronic Sinus Disease1023
- MURPHY, ARTHUR J. (with BUGBEE, HENRY G.).....1003
- MUZII, MARIO. Some Consideration of 4,600 Radiologic Examinations in the Past Six Years 941
- NEYMANN, CLARENCE A., and OSBORNE, S. L. The Treatment of Dementia Paralytica, with Hyperpyrexia Produced by Diathermy..... 993
- NONNENBRUCH. The Limits between the Normal and Pathologic in the Lung Roentgenogram 989
- OSBORNE, S. L. (with NEYMANN, CLARENCE A.)..... 993
- OSGOOD, ROBERT B. Orthopedic Aspects of Chronic Rheumatism or Arthritis..... 975
- OTTAVIANI, GAETANO (with PERONA, PIETRO).....1010
- OVERHOLT, RICHARD H. Air in the Peritoneal Cavity: Its Effect on the Position and Activity of the Diaphragm..... 994
- PACK, GEORGE T., and CRAVER, LLOYD F. Radiation Therapy of Polycythemia Vera.....1018
- PALMER, J. P., and TAFT, ROBERT B. Spontaneous Pneumothorax 990
- PALUGYAY, JOSEF. The Lower Esophagus and Upper Portions of the Stomach as Seen by the Roentgenologic Examination..... 996
- Idem. Results of Roentgenotherapy of Surgical Tuberculous Diseases1022
- PARENTI, SILVIO. Dental Radiology in its Most Common Applications 993
- PARHON, C. I., and PARHON-STÉFANESCO, CONSTANCE. A New Syndrome: Hyperfunction of the Hypophysis in Childhood.....1024
- PARHON-STÉFANESCO, CONSTANCE (with PARHON, C. I.)1024
- PAULSON, MOSES (with ANDREWS, JUSTIN)..... 904
- PEMBERTON, RALPH (with GOLDHAFT, ARTHUR D., and WRIGHT, LILLIE M.)..... 975
- PEMBERTON, RALPH. Developments in the Problem of Arthritis..... 976
- PENDERGRASS, EUGENE P., GILMAN, ROBERT L., and CASTLETON, KENNETH B. Bone Lesions in Tardive Heredosyphilis..... 978
- PENDERGRASS, EUGENE P. Indications and Contra-indications of Encephalography and Ventriculography1024
- PERONA, PIETRO, and OTTAVIANI, GAETANO. A Study of the Right Cardiovascular Border.....1010
- PETERSEN, W. F. (with MILLES, G., and MÜLLER, E. F.)1002, 1004
- PFAHLER, G. E., and VASTINE, J. H. Radiation Therapy in Cancer of the Mouth, with Especial Reference to the Use of Pure Gamma Rays 988
- PIERGROSSI, ALDO. A Case of Eburnizing Osteitis of a Single Bone (Meloreostosis)..... 977
- PLATT, HARRY. Cysts of the Long Bones of the Hand and Foot..... 984
- POMERANZ, R. The Diaphragm: A Clinical and Roentgenologic Study 991
- PRAY, RALPH E. Thymic Disorders: Their Recognition and Treatment, with a Report of Sixteen Cases1027
- RANKIN, FRED W. The Diagnosis of Malignant Conditions of the Colon..... 998
- REIGENBAUM, J. (with RIVEN, SAMUEL S.).....1010
- REINECKE, HAROLD G. (with BROWN, SAMUEL)..... 990
- RIGLER, LEO G. The Early Diagnosis of Carcinoma of the Stomach..... 998
- RIVEN, SAMUEL S., and FEIGENBAUM, J. Syphilis

of the Aorta and Heart: A Clinical Study.....	1010	SVÁB, VÁCLAV. A Case of Aleukemic Leukemia of the Stomach and its Roentgenologic Findings.....	997
ROHRHIRSCH, OTTO. Primary Sarcoma of a Vertebra.....	1026	SWEETSER, THEODORE. Intravenous Urography in the Diagnosis of Renal Tuberculosis: Case Report.....	1006
ROMANOFF, A. (with MASTER, A. M.).....	1010	TAFT, ROBERT B. (with PALMER, J. P.).....	990
DE RUDDER, BERNHARD. The Problem of the Sea- sonal Diseases.....	941	TALIA, F. Amebic Subdiaphragmatic Abscess.....	973
SAMPSON, HOMER L., and BROWN, LAWRASON. The Value of the Roentgenologic Examina- tion in Pulmonary Tuberculosis.....	1030	Idem. Painful Hemisacralization of the Sixth Lumbar Vertebra.....	1026
SCHAEFER, W., and WITTE, E. Contributions to the Biological Effects of Modern Cathode- ray Tubes.....	973	TUVE, M. A. (with WHITMAN, W. G.).....	1015
SCHLECHT, H. (with HESZ, P.).....	1029	ULLMANN, H. J. Minimum Requirements for Roentgenography.....	1019
SCHLIEPHAKE, ERWIN. On the Depth Effect and the Elective Action on Tissue Produced by Short Electrical Waves.....	973	VAN GOIDSENHOVEN, F. (with APPELMANS, R., and BOINE, J.).....	1000
SCHULTZE, WALTHER. Temperature Measure- ments in the Skin and Their Relation to the Degree of Cooling.....	994	VASTINE, J. H. (with PFAHLER, G. E.).....	988
SEAR, H. R. Some Notes on the Value of X-rays in Pregnancy.....	1009	VILLA, LUIGI. Study of the Morphogenesis of the Cells of Sternberg in Hodgkin's Disease.....	1011
SEIDLER, FERDINAND (with BERKHEISER, E. J.).....	980	VYNÁLEK, WILLIAM J. (with HERBST, ROBERT).....	1008
SHACKELFORD, RICHARD T. Hydropneumoperi- cardium: Report of a Case, with a Summary of the Literature.....	1011	WANGENSTEEN, O. H. (with CARLSON, H. A., DVORAK, H. J., LYNCH, F. W., and BORMAN, C.).....	995
SHERMAN, GEORGE A. Hodgkin's Disease, with Special Reference to Diagnostic Difficulties, and Results Following Roentgen Irradia- tion: Report of a Case.....	1012	WEISS, THEODOR. Diagnosis of the Mesenterium Commune.....	932
SIMSON, J. (with LEESER, F.).....	975	WERTHEMANN, A. (with LÜDIN, M.).....	990
SIPERSTEIN, DAVID M. Acute Intussusception in Infancy: Operative and Non-operative Treatment.....	1000	WERTHEMANN, A. Experimental Roentgen In- juries of the Heart Muscle.....	994
SMITH, CLAYTON S., and WIKOFF, HELEN L. Pharmacology of Brominated Oils.....	992	WEST, JOHN H. The Thymus Problem to Date, Based on a Study of 475 Mediastinal Radi- ographs.....	1027
SMITH, EMERSON. An Unusual Case of Unilat- eral Renal Bleeding.....	1006	WHITE, WILLIAM CRAWFORD. The Diagnosis and Treatment of Carcinoma of the Breast.....	986
SNELLER, CHARLES D. Pork Bone in Bronchus Causing Symptoms Simulating Pulmonary Tuberculosis.....	988	WHITMAN, R. W. Diverticulitis of the Colon, with Special Reference to Acute Perfora- tions of the Sigmoid.....	997
STEARNS, GENEVIEVE, and BOYD, JULIAN D. The Healing of Late Rickets Coincident with Low Serum Phosphate.....	1016	WHITMAN, W. G., and TUVE, M. A. Biological Effects of Gamma Rays.....	1015
STEINDLER, ARTHUR. The Tabetic Arthropathies.....	983	WIKOFF, HELEN L. The Preparation of Some Brominated Oils and Brominated Esters.....	992
STEWART, A. Solitary Diverticulitis of the Cecum.....	996	WIKOFF, HELEN L. (with SMITH, CLAYTON S.).....	992
		WILKE, A. Bilateral Disease of the Os Nav- iculare Pedis in Adults.....	932
		WILSON, SIDNEY J. Cancerous Moles.....	988
		WITTE, E. (with SCHAEFER, W.).....	973
		WOYTEK, GEORG. Excretion Urography with Abrodil (Skiodan).....	1006
		WRIGHT, LILLIE M. (with GOLDBAFT, ARTHUR D., and PEMBERTON, RALPH).....	975

INDEX TO VOLUME XVI

- Abadie, Jules, 242, 922.
 Abbé, Robert, 30, 37.
 Abbott, A. C., 105.
 Abbott Laboratories, 74.
 [Abdomen] Abdominal viscera, Year's progress in roentgenography of (abstract), 972.
 Abdomen, opaque formations in, with special regard to dermoid cysts and splenic calcifications, Discussion of, A. Vallebona (abstract), 828.
 Abell, Irvin, 620.
 Abitz, W., 595.
 Abramowitz, E. W., 702.
 Abrodil (Skiodan), Anaphylactic state after injection of, H. Horsters (abstract), 1007.
 Abscess, Amebic subdiaphragmatic, F. Talia (abstract), 973.
 Abscesses, post-appendicitis, Roentgen symptoms of, R. Pohl (abstract), 573.
 Abscess, Subphrenic, Gatewood (abstract), 972.
 Abscess, subphrenic, on post-appendiceal basis, Roentgenologic appearance of, O. Meller (abstract), 620.
 Absorption measurements of X-ray general radiation, L. S. Taylor, 302.
 Acetabulum, Fractures of, W. R. Cubbins, A. H. Conley, and J. J. Callahan (abstract), 82.
 Achlorhydria, Clinical syndromes that include, J. S. McLester (abstract), 100.
 Ackman, F. D., 103.
 Actinomycosis (mycetoma): report of six cases in Georgia, J. W. Jones and H. S. Alden (abstract), 417.
 Actinotherapy in pediatrics, G. La Pierre (abstract), 1016.
 Adams, Roy, 391.
 Adelstein, Leo J., 818.
 Adenocarcinoma of bronchus, with widespread metastases: case report, W. S. Middleton, E. A. Pohle, and G. Ritchie, 945.
 Adenocarcinoma of uterus, radiotherapy in, Results of, A. Lacassagne (abstract), 88.
 Adenoma, Origin of polypi of large bowel, with especial reference to: preliminary report, W. A. Fansler (abstract), 624.
 Adenopapillomata, Multiple, of stomach, with report of case showing varying degrees of malignancy, F. D. Ackman (abstract), 103.
 Adler (cited by E. Zweifel), 585.
 Adolescence, deforming bone diseases of, A. L. Gray (abstract), 84.
 Africa, silicosis in, 604.
 Agati, Dino, 82.
 Ageev, N. V., 783.
 Agranulocytosis, Roentgen therapy of, F. Burgheim (abstract), 417.
 Aichel, O., 922.
 Aimes, A., 922.
 Air pressure, Influence of, on formation of erythema and pigmentation in skin, F. Schmidt-La-
 baume and E. Uhlmann (abstract), 421.
 Akerlund, Ake, 485.
 Albanese, Armando, 922.
 Albee, Fred H., 922.
 Albers-Schönberg, H. E., 702.
 Albers-Schönberg's disease, 162, 167.
 Albrecht, E., 973.
 Albrecht, Hans, 109.
 Albrecht, H. U., 849, 855, 967.
 Alden, Herbert S., 417, 979, 980.
 Alessandri, P., 923.
 Alexander, Arthur, 818.
 Alexander, John, 403, 991.
 Alexander, W., 923.
 Alfandary (cited by W. W. Belden), 926.
 Alimentary tract in Flajani-Basedow's disease, P. Ottonello (abstract), 101.
 Allen, Alexander J., 571.
 Allen, Bundy (portrait), facing 68.
 Allen, Ellery, 59.
 Allen, Kenneth D. A., 492-507, 602.
 Allen, Kenneth D. A., Post-operative behavior of diaphragm, 492. *See other references.*
 Allison, Nathaniel, 179.
 Allison, R. G., 564.
 Alvarez, W. C., 851, 855.
 Amenorrhea, roentgen, temporary, Means for exact dosage in carrying out, T. C. Neeff (abstract), 401.
 Amenorrhea, roentgen, temporary, Scientific and experimental foundations of, H. Wintz (abstract), 401.
 Amenorrhea, Temporary, in treatment of endometrial tumors of ovary and peritoneum, H. Albrecht (abstract), 109.
 Amenorrhea, temporary roentgen, Clinic of, C. J. Gauss (abstract), 110.
 American College of Physicians, 390.
 American College of Radiology, 744.
 American College of Surgeons, 90, 378, 881. *See also Bone Sarcoma Registry.*
 American Committee for the Control of Rheumatism, 975.
 American Congress of Physical Therapy, Program of, 729.
 American Medical Association, 387, 728; Committee on Scientific Research, 75; Council on Pharmacy and Chemistry, 74; Council on Physical Therapy, 727, 729, 744.
 American Physiotherapy Association, 728.
 American Society for the Control of Cancer, 291, 369, 376-379.
 American Urological Association, 108.
 Amniography (preliminary report), T. O. Menees, J. D. Miller, and L. E. Holly (abstract), 401.
 Andersen, E. B., 335, 338.
 Anderson, Hjalmar S., Lesions of clavicle, 181.
 Anderson, N. P., 703.
 Anderson, R. J., 803.
 Anderson, William T., Jr., 836.
 d'Andral (cited by E. Devic, P. Savy, and E. Freedman), 25.
 Andrassy (cited by W. W. Belden), 923.
 André, Gunnar, 932.
 Andresen, Albert F. R., 573.
 Andrews, George C., 78, 79, 738, 743.
 Andrews, Justin, 904.
 Andrus, Paul M., and Hambleton, A., Focal spot projection and position of X-ray tube in radiography, 869.
 Andrus, William De W., 499, 507.

- Ané, J. N., 996-998, 1003, 1004, 1010, 1016.
 Anemia, pernicious, 100.
 Anencephaly: diagnosis, importance of pre-natal, with report of case, Hyman I. Teperson, 334.
 Aneurysm, Four cases of, H. E. MacDermot (abstract), 402.
 Angevine, D. M., 830.
 Angina pectoris, pain of, Differential diagnosis of, and radicular syndrome of hypertrophic osteoarthritis of spine, D. C. Sutton (abstract), 426.
 Angioma racemosum in skull, L. Frigýér (abstract), 423.
 Angirany, D. V., 968.
 Anomalies, renal rotation and associated, Anomalous, W. F. Braasch (abstract), 795.
 Ano-rectal region, Three primary malignant epithelial tumors of, occurring in one person, D. M. Angevine (abstract), 830.
 Anschütz (cited by M. Haudek and J. D. Camp), 851, 855.
 Anson, B. J., joint-author, 52.
 Antral disease, chronic, Rational surgical treatment of, J. G. Hunt (abstract), 817.
 Antrum disease, Chronic, L. E. Patrick (abstract), 815.
 Antrum, maxillary, Diagnosis and treatment of inflammation of, P. G. Goldsmith (abstract), 816.
 Antrum pylori, Segmentary toxic gastritis of, L. Giuntoli (abstract), 97.
 Anzellotti, Alberto, 98, 100.
 Aorta, coarctation of (adult type), Roentgenologic diagnosis of, W. W. Fray (abstract), 403.
 Aorta, Rupture of, C. J. Tidmarsh (abstract), 402.
 Aorta, Uncoiled: Part II.—Pathologic aorta, D. S. Dann (abstract), 402.
 Appelmans, R., 1000.
 Appendicitis, chronic, Roentgen diagnosis of, H. J. Walton and S. Weinstein (abstract), 572.
 [Appendicitis] Post-appendicitis abscesses, Roentgen symptoms of, R. Pohl (abstract), 573.
 Appendix, Pathologic, A. F. R. Andresen (abstract), 573.
 Appendix, Roentgenologic observations of appendix, W. Knothe (abstract), 572.
 Appendix, Roentgenology of, J. W. Larimore (abstract), 974.
 Appendix, X-ray examination of, Comments on, J. T. Case (abstract), 974.
 Archambault, Gustave, 422.
 Archer, Vincent W., 99, 623, 757, 759.
 Archer (cited), 973.
 Arendt, Julian, 403, 821, 993.
 Arlabosse (cited by W. W. Belden), 923.
 Armstrong, George, 999.
 Arneson, A. I., 572.
 Arnould (cited by W. W. Belden), 926.
 Arrivot, P., 923.
 Arthritis, chronic, Orthopedic aspects of rheumatism or, R. B. Osgood (abstract), 975.
 Arthritis, endocrine, So-called, F. Leiser and J. Simson (abstract), 975.
 Arthritis, hypertrophic, Production of, by interference with blood supply, A. D. Goldhaft, L. M. Wright, and R. Pemberton (abstract), 975.
 Arthritis, problem of, Developments in, R. Pemberton (abstract), 976.
 Arzt, Leopold, 702.
 Asbestosis bodies in sputum and lung, K. M. Lynch and W. A. Smith (abstract), 94.
 Asbury, Eslie, 923.
 Ascariasis, Roentgen diagnosis of, V. W. Archer and C. H. Peterson (abstract), 623.
 Aschner, Paul W., 790.
 Asdell, Sydney A., 814.
 Ashley, L. B., 65.
 Assmann, Herbert, 16, 17, 19, 28, 330, 332, 485, 823, 990.
 Association for the Development of Medical Relations, 962.
 Asthma, bronchial, Roentgenotherapy of, G. M. Sack (abstract), 414.
 Atelectasis and emphysema, Mechanism of physical signs in neoplastic and other diseases of lung, with especial reference to, C. Jackson (abstract), 93.
 Atlanto-axial joint, Non-traumatic dislocations of, E. J. Berkheiser and F. Seidler (abstract), 980.
 Atsatt, Rodney, 744.
 Aubert, Edmond, 923.
 Aubert (cited by E. Zweifel), 585.
 Aufses, Arthur H., 986.
 Aurelius, J. R., 855.
 Awalischwili, G. Gr., 83.
 Axhausen (cited by G. Jansson), 578.
 Bastrup (cited by A. Salotti), 86.
 Bachem, Albert, 729.
 Bachrach, Robert, 828.
 Backmund, Karlheinz, 414.
 Bacterial flora in uterine carcinomata treated with radium, A. M. Bonanno (abstract), 407.
 Badgley, C. E., 765.
 Badolle (cited by W. W. Belden), 927.
 Baer, W. S., 234, 242.
 Baetjer, Frederick H., 911, 923.
 Baggs, H. J., 50.
 Bagnaresi, Giacomo, 998.
 Bailey, Cornelius Oliver, 588.
 Bailey, Frederick H., 352.
 Bailey, Percival, 553.
 Baker, Lillian E., 322, 327.
 Baker, W. Morant, 187.
 Bakwin, Harry, 743, 834.
 Bakwin, Ruth M., 743, 834.
 Baldwin, W. M., 338, 710, 718.
 Balestra, Giovanni, 92, 818.
 Balfour, D. C., 270, 855.
 Balfour (cited by F. D. Ackman), 103.
 Ballantyne, John W., 334, 338.
 Ballon, David H., 612.
 Banerjee, Kedareswar, 593, 594.
 Barga, J. Arnold, 824.
 Barium sulphate, Effect of, upon incidence of human intestinal protozoa, J. Andrews and M. Paulson (abstract), 904.
 Barker, Howard H., 807.
 Barker, Paul S., 403.
 Barnard, Leonard, 978.
 Barnes, J. M., 302, 317-319.
 Barney, J. Dellinger, 796.
 Barr, David P., 431.
 Barrett, Charles S., Gezelius, Roy A., and Mehl, Robert F., Technic of radiography by gamma rays, 461.
 Barrett, Charles S., joint-author, 508.
 Barrie, G., 657.
 Barrow, S. C., 434, 599, 601, 602, 1030.
 Barry, M. W., 302, 317.
 Bartlett, Edwin I., 829, 985.
 Basedow's disease and its radiotherapeutic estimation: Polarization measurements on human skin, H. Regelsberger (abstract), 399.
 [Basedow's disease] Flajani-Basedow's disease, Alimentary tract in, P. Ottonello (abstract), 101.
 Basedow's disease in older women, Our method of X-ray therapy of, A. Jugenburg (abstract), 432.
 Basedow's disease, X-ray treatment of, Causes of

- success and failure in, P. Heszy and H. Schlecht (abstract), 1029.
- Basset, Antoine, 923.
- Bastian, G., 406.
- Batten, G. B., 686.
- Battle Creek Sanitarium, 334, 974.
- Baumecker, Heinz, 619.
- Bayer, S., 234, 242.
- Bayles, William H., 73.
- Bazett, H. C., 707, 718.
- Beall, K. H., 412.
- Beals, J. A., 944.
- Beasley, I. E., 703.
- Beaver, M. G., 507.
- Bec, François, 480, 482.
- Beck, Emil G., 244.
- Becker, J., 1003.
- Becker (cited by J. S. Coulter and E. M. Smith, Jr.), 739.
- Becker-Manheimer, Olga, 702-704.
- Béclère, Antoine, 417, 960.
- Béclère, Claude, 960.
- Bedford, George V., 582.
- Beer, Edwin, 78, 1007.
- Behnken, Hermann, 2, 3, 7, 8, 10-12, 304, 611.
- Behrend, Moses, 621.
- Beisler, L. G., 480, 482.
- Belden, Webster W., 392-394, 905-932.
- Belden, Webster W., Fifth lumbar vertebra roentgenologically demonstrated, 905. *See other references.*
- Belfield, William T., 933, 935.
- Bell, Blair, 415, 439.
- Belot, M., 357, 960.
- Belt, T. H., 604.
- Benassi, G., 923.
- Bence-Jones bodies, 195, 228.
- Benedict, Edward B., 831.
- Benedict (cited by W. Devrient, S. Thyssen, and B. Sokoloff), 749.
- Berens, Conrad, 772.
- Berg, H., 95.
- Berg, H. H., 849, 855, 999.
- Berg, Richard F., 655.
- Berg (cited by H. U. Albrecht), 967.
- Berger, Hans, 827.
- Berger, Heinz, 611.
- Berkheiser, E. J., 980.
- Bermond, Marco, 617.
- Bernard (cited), 1015.
- Bernheimer, H. C., 772.
- Bernstein, Mitchell, 328, 330, 332.
- Best, Elmer S., 992.
- Betocchi, Giorgio, 423.
- Bettman, H. J., 244.
- Bevan, A. D., 539.
- Bhargava, Saligram, 595.
- Bierman, Morris I., 923.
- Bigelow Clinic, 944.
- Biggam, A. G., 923.
- Bignami, G., 395.
- Biliary colic in routine cholecystography, I. Gray and M. J. Matzner (abstract), 97.
- Biliary tract visualization with radiopaque oils, R. H. Overholt (abstract), 613.
- Billich, H. U., 416.
- Billroth, Theodor, 144.
- Binger, Carl A. L., 707, 718.
- Binkley, George E., 588.
- Binks, W., 4, 5, 7, 8.
- Binz (cited), 108, 794, 972.
- Biopsy, 437, 641.
- Birkett, G. E., 587, 588, 590.
- Birnbaum (cited by H. Brunn and S. Brill), 608.
- Birth traumatism as factor in urinary infection, F. S. Patch (abstract), 107.
- Birthmarks and their treatment, G. Andrén (abstract), 932.
- Bischoff, F., 706, 707, 718.
- Bishop, W. W., 384.
- Bittorf, A., 330, 333.
- Björling, E., 784.
- Blackberg, S. N., 998.
- Bladder, cancer of, Radical treatment of, R. C. Coffey (abstract), 89.
- Bladder tumor pathology, Clinical application of, P. W. Aschner (abstract), 790.
- Bladder, urinary, Consideration of surgical procedures in treatment of malignant disease of, V. C. Hunt (abstract), 797.
- Blaine, Edward S., 978.
- Blanchard, L. H., 335, 338.
- Blankenhorn, M. A., 804.
- Blasius (cited by A. Steindler), 983.
- Bloch, Leon, 625.
- Blocher, Mrs. J. F., Head clamps for fenestrated shield for roentgenography of nasal accessory sinuses, 554.
- Blood cholesterol in malignant disease, Further studies of effect of radiation on, W. L. Mattick and M. C. Reinhard (abstract), 575.
- Blood injuries following roentgen irradiation with old treatment technic and ray-proof Metalix tubes, Comparative studies of, W. Fürst (abstract), 575.
- Blood of radiologists, Researches on, J. Lavedan (abstract), 573.
- Blood phagocytes in irradiated guinea pigs, Behavior of, L. Pincussen (abstract), 574.
- Blood pressure, Fluctuations of, following X-ray treatment and clinical significance, H. Pausdorf and W. Nell (abstract), 574.
- Blood serum, diagnosis of carcinoma from, Some notes on, H. M. Jamieson (abstract), 584.
- Blood sugar regulation under influence of roentgen rays, A. Held (abstract), 411.
- Blood supply, interference with, Production of hypertrophic arthritis by, A. D. Goldhaft, L. M. Wright, and R. Pemberton (abstract), 975.
- Blood supply of gall bladder, A. Rubascheva (abstract), 97.
- Blood vessels, Uroselectan in demonstration of (vasography) and especially of varicosities, M. Ratschow (abstract), 609.
- Blood vessel visualization, New method of (arteriography, veinography, angiography), M. Saito, K. Kamikawa, and H. Yanagizawa (abstract), 608.
- Bloodgood, Joseph C. (portrait), facing 111, 137, 179, 191, 200, 202, 210, 214, 215, 219, 220, 223, 232, 391, 649, 653, 663, 664, 671, 672, 678, 679, 685, 693, 694, 754, 757, 769, 960.
- "Blue sclera," 168.
- Blumensaat, Carl, 992.
- Blumenthal, Franz, 702.
- Boas, Harald, 578.
- Boddin (cited by L. B. Dickey), 1029.
- Boeck's sarcoid, 328-333.
- Boeminghaus, H., 923.
- Bogan, I. K., 495, 507.
- Bogan, M. E., 802.
- Böhm, Alexander, 1021.
- Böhm, J., 779.
- Böhmer, Lothar, 805, 838.
- Boice, Edmund S., 90.
- Boils and carbuncles, Treatment of, by roentgen rays, E. T. Leddy and S. A. Morton (abstract), 411.

- Boine, J., 1000.
 Boldingh, W. Hondius, 406, 571.
 Bollman, Jesse L., 719.
 Bolton, Charles, 481, 482.
 Bonanno, A. M., 407.
 Bond, W. N., 302.
 Bone abscess (Brodie), chronic, Two cases of unusual localization of, A. Mariupolsky (abstract), 579.
 Bone, callus in, Relationship between hypophysis and formation of: experimental study, A. Spinelli and F. Talia (abstract), 577.
 Bone, carcinomatous metastasis of, Value of roentgenotherapy in, A. Ratti (abstract), 414.
 Bone changes, atypical, in osteitis chronica deformans Paget, Contribution to question of, G. Bastian (abstract), 405.
 Bone changes in chronic empyema, case of, T. Dale (abstract), 575.
 Bone changes in Hodgkin's disease, K. Kremser (abstract), 804.
 Bone cysts, A. R. Colvin, 683.
 Bone cyst of patella, Final report on case of, Wallace H. Cole, 752.
 Bone diseases of adolescence, deforming, A. L. Gray (abstract), 84.
 Bones, diseases of, benign and malignant, Roentgenological differentiation of, R. Kienböck (abstract), 577.
 Bone fragility, 166, 168, 170.
 Bones, hands and feet, of, An X-ray and clinical study of, Max Kahn, 211.
 Bone, infections of, 136, 137.
 Bone lesions in tardive herodesyphilis, E. P. Pendergrass, R. L. Gilman, and K. B. Castleton (abstract), 978.
 Bone lesions of fingers, infective, Conservatism in treatment of, L. H. McKim (abstract), 981.
 Bone lesions of lower radius, Robert Lee Oliver, 245.
 Bone, lesions of, Working rules for, C. F. Geschickter (editorial), 288.
 Bone lesions, rare, 222.
 Bones, long, of hand and foot, Cysts of, H. Platt (abstract), 984.
 Bone marrow, Experimental studies concerning effect of roentgen rays on (II), A. Casati (abstract), 994.
 Bone metastases: study of 334 cases, M. M. Copeland, 198.
 Bone metastasis, X-ray treatment of, C. B. Rose, 536.
 [Bone] Osseous development, normal, Roentgenographic studies in, E. K. Shelton (abstract), 979.
 Bone, Paget's disease of, Harvey Smith, 694.
 Bone Sarcoma Registry, 639, 641, 643, 646-653, 664, 694. *See also* American College of Surgeons and Codman, E. A.
 Bone, semilunar, Kienböck's disease of, N. Porro (abstract), 577.
 Bone suppuration and renal calculi in children, M. C. Borman (abstract), 793.
 Bone, syphilis of, 137, 140, 141, 146, 147, 149. *See also under* Syphilis.
 Bone, syphilis of, Congenital: case report, L. R. Lingeman, 953.
 Bone, tuberculosis of, 137, 139, 140, 147, 149.
 Bone tumors among ex-service men, Study of, P. B. Matz, 664.
 [Bone tumor] Bone case, Obscure, I. S. Trostler, 949.
 Bone tumors, Giant-cell: four cases successfully treated by roentgen rays, L. T. LeWald (abstract), 84.
 Bone, tumors of, Giant-cell: clinical, histological, and radiotherapeutic study, H. Lacharité (abstract), 84.
 Bone tumors, primary, of extremities, Pathological fractures in, B. L. Coley and G. S. Sharp (abstract), 581.
 Bone tumors, Roentgenologic diagnosis of, C. F. Geschickter, 111-180.
 Bone tumors, Treatment of, E. I. Bartlett (abstract), 985.
 Bonniot, A., 923.
 Book reviews, 76-79, 394, 395, 564, 565, 773, 965-970.
 Boquel, G., 923.
 Bordeaux (France), University of, post-graduate courses, 392.
 Bordier (cited by G. Harker), 783.
 Borman, C., 995.
 Borman, Milton C., 793.
 Bortz, Edward L., 624.
 Bortz (cited by H. Smith), 695.
 Botreau-Roussel (cited by W. W. Belden), 923.
 Bouwers, A., 29, 353-358, 571.
 Bouwers, A., "Quality" of X-ray tube and how to measure it, 353. *See other references.*
 Bowen (cited by H. Brunn and S. Brill), 608.
 Bowen's disease, 443.
 Bower, J. O., 52, 58, 546, 833.
 Bowker, John, 384.
 Bowman, William B., 70, 923.
 Boyd, Julian D., 1016.
 Boyd, William, 87.
 Braasch, William F., 108, 795, 1004, 1005, 1007.
 Bradbury, L. A., 480, 482.
 Bradford, E. H., 242.
 Brady, James Buchanan, Foundation of Urology of New York Hospital, 795.
 Braekken, H., 593.
 Braestrup, Carl B., 773.
 Bragg, J. S., 764.
 Bragg, W. H., 360, 465, 597.
 Brailsford, James F., 923.
 Brain, fixed lesions of, Encephalography in cases with, B. Crothers, E. C. Vogt, and R. C. Eley (abstract), 423.
 Brain tumor, Indirect signs of, as noted in routine roentgen examinations: displacement of pineal shadow: survey of 3,000 consecutive skull examinations, C. G. Dyke (abstract), 424.
 Brain tumor, roentgen treatment of, Further experience with, K. Backmund (abstract), 414.
 Brams, William A., 802.
 Braun, H., 480, 482.
 Braun, R., 411.
 Braunbek, Werner, 781.
 Braunlich, George, 924.
 Brdiczka, I. G., 602.
 Breast, Adenocarcinoma of: Case report: Six-year interval following amputation of breast—final general osseous metastasis, G. S. Foster, 759.
 Breast, Cancer of, E. S. Boice (abstract), 90.
 Breast, Cancer of, A. Soiland (abstract), 587.
 Breast, cancer of, early, Diagnosis and treatment of, W. L. Hearst (abstract), 582.
 Breast, cancer of, Place of X-rays in treatment of malignant disease, with especial reference to, F. Hernaman-Johnson (abstract), 1017.
 Breast, carcinoma of, Diagnosis and treatment of, W. C. White (abstract), 986.
 Breast, carcinoma of, Radium treatment of primary, G. Keynes (abstract), 1015.
 Breast, carcinoma of, Roentgen treatment of metastasis to vertebræ and bones of pelvis from, E. T. Leddy (abstract), 811.

- Breast, Roentgenologic study of, S. L. Warren (abstract), 696.
- Breast, Treatment of advanced cancer of, William F. MacFee, 687.
- Breitschneider (cited by E. Zweifel), 585.
- Brenzinger, M., 77.
- Bressot, E., 924.
- Brettauer (cited), 585.
- Brewer, George, 1007.
- Brichteteau (cited), 1011.
- Briggs, W. T., 234, 242.
- Brill, R., 780.
- Brill, Selling, 494, 507, 607.
- British Empire Cancer Campaign, Report of, to House of Lords, 366, 368.
- "Brittle bones," 168.
- Brock, R. C., 480, 482.
- Broders, Albert C., 660, 663, 687, 693, 891.
- Brodie, B., 133, 179.
- Brodie, Robert, 704.
- Brodie's abscess, 129, 130, 133-136, 139, 140, 579.
- Bromer, Ralph S., 409, 989.
- Bronchiectasis: analysis of 51 cases, W. W. Priddle (abstract), 601.
- Bronchiectasis, Differential diagnosis of pulmonary tuberculosis, lung abscess and, F. P. McNamara (abstract), 823.
- Bronchography—passive technic, F. H. Cooley (abstract), 599.
- Bronchomycosis: report of 2 cases, W. R. Stokes, E. F. Kiser, and W. H. Smith (abstract), 604.
- (Bronchopneumonia) lobular pneumonia, Roentgenologic appearance of, N. W. Potte (abstract), 94.
- Bronchus, Adenocarcinoma of, with widespread metastases: case report, W. S. Middleton, E. A. Pohle, and G. Ritchie, 945.
- Bronner, H., 792.
- Brooke, Charles R., 29.
- Brooklyn Roentgen Ray Society, 73.
- Brooks, C. D., 65.
- Brooks (cited by L. S. Taylor), 894.
- Brown, Lawrason, 1030.
- Brown, Philip King, 615.
- Brown, Ralph C., 625.
- Brown, Richard Mark, 70.
- Brown, Samuel, 428, 429, 990.
- Brown (cited by C. E. Weaver), 64.
- Brubaker, Albert P., 507.
- Brunn, H., 494, 507.
- Brummer, K., 835.
- Brunn, Harold, 607.
- Brunschwig, Alexander, 995.
- Bryan, Lloyd, 831.
- Buchholz (cited by E. Zweifel), 585.
- Buckingham, William W., 991.
- Buckley (cited by E. H. Funk), 582.
- Bucky, Gustav, 697-699, 702, 703, 797.
- Budapest, Second University Clinic for Women at, Development of gynecological roentgen therapy during past ten years in, F. Gál (abstract), 400.
- Bueerman, W. H., 855.
- Buell, Blinn A., 563.
- Bugbee, Henry G., 1003.
- Buisson, H., 835.
- Buisson, Mario, 617.
- Buisson, Paolo, 617.
- Bulger, Harold A., 431.
- Bull, William T., 627.
- Bumpus, Hermon C., Jr., 204, 210, 790.
- Bunting, C. H., 450, 459.
- Burby, J. J., 302, 317.
- Burckhardt, Hans, 924.
- Burdick, Alfred S., 74.
- Burgheim, F., 417.
- Burgheim (cited by R. Hummel), 806.
- Burill (cited by W. W. Belden), 925.
- Buschke, Abraham, 703, 807.
- Büssem, Wilhelm, 597.
- Bustos, Fernando M., 924.
- Büttner, K., 806.
- Buxton, B. H., 628.
- Buzzi, Alfredo, 924.
- Cabot, Hugh, 602.
- Cabot, Richard C., 480, 482.
- Cade, Stanford, 586-588, 591, 800, 887, 891.
- Cade (cited by W. W. Belden), 924.
- Cahen, Roger, 704.
- Caillet, O. R., 712, 719.
- Cain, M. A., 60.
- Cain, R. M., 74.
- Calcification, intracranial, with particular reference to that occurring in gliomas, C. B. Courville and L. J. Adelstein (abstract), 818.
- Calcium in connective tissue, Unusual deposition of, M. Cohn and Freye (abstract), 417.
- Caldwell (cited by J. G. Hunt), 817.
- California and Western Medicine, cited, 59.
- California Institute of Technology, experimental tube developed at, 300.
- California, University of, 379.
- Callahan, James J., 82.
- Callender, George R., 598.
- Calvé, Jacques, 1025.
- Cameron, H. C., 242.
- Camp, Carl D., 818.
- Camp, John D., 422, 564, 847-855.
- Camp, John D., Roentgenologic significance of pyloric and prepyloric deformities, 847. *See other references.*
- Campbell, A. M., 335, 338.
- Campidol (iodized rapeseed oil), 614.
- Campidol (iodized rapeseed oil): use in roentgenographic visualization of body cavities, M. A. Glaser (abstract), 992.
- Canadian Medical Association, 563.
- Canadian Radiological Society, 1014.
- Canavero, Gioachino, 924.
- [Cancer] Adenocarcinoma of breast: Case report: Six-year interval following amputation of breast—final general osseous metastasis, G. S. Foster, 759.
- Cancer, advanced, Clinical evaluation of radium and roentgen therapy in, with various combinations of wave lengths, B. P. Widmann and J. L. Weatherwax (abstract), 585.
- [Cancer] Cancerous moles, S. J. Wilson (abstract), 988.
- Cancer Commission of League of Nations, 366, 368.
- Cancer development, On mechanism of, H. Oertel (abstract), 86.
- Cancer, Diagnosis of, F. C. Wood (abstract), 583.
- Cancer, Intra-oral, and treatment, A. Soiland and O. N. Meland (abstract), 91.
- Cancer, intra-oral, Treatment of, with special reference to radium therapy, D. Quick (abstract), 591.
- Cancer of bladder, Radical treatment of, C. Coffey (abstract), 89.
- Cancer of breast, E. S. Boice (abstract), 90.
- Cancer of breast, A. Soiland (abstract), 587.
- Cancer of breast, early, Diagnosis and treatment of, W. L. Hearst (abstract), 582.
- Cancer of breast, Place of X-rays in treatment of malignant disease, with especial reference to, F. Hernaman-Johnson (abstract), 1017.
- Cancer of breast, Treatment of advanced, William F. MacFee, 687.

- Cancer of cervix, Pelvic irradiation in, P. Findley (abstract), 987.
- See also* Cancer of uterine cervix and Cancer of uterus.
- Cancer of esophagus: analysis of 82 cases, E. P. McCullagh (abstract), 589.
- Cancer of lip, tongue, and skin: Ministry of Health report, J. Lane-Claypon (abstract), 987.
- Cancer of mouth and lips, Radiation therapy in treatment of, J. M. Martin, 881.
- Cancer of mouth, Radiation therapy in, with especial reference to use of pure gamma rays, G. E. Pfahler and J. H. Vastine (abstract), 988.
- Cancer of nose, larynx, and esophagus, Radium therapy in, H. M. Moran (abstract), 808.
- Cancer [of rectum], treatment of, Factors influencing, G. E. Binkley (abstract), 588.
- Cancer of stomach, Diagnosis and treatment of, P. Riddle (abstract), 582.
- Cancer of stomach, gastric retention, Great, and dilatation of stomach in cases of gastroduodenal ulcer and, T. Klason (abstract), 614.
- Cancer of stomach, Radiological signs of early, A. Salotti (abstract), 86.
- Cancer of tongue, Radium and surgery in, D. Quick (abstract), 592.
- Cancer of tongue, Radium treatment of (symposium), Stanford Cade (abstract), 587.
- Cancer of tongue, Radium treatment of, S. Cade (abstract), 591.
- Cancer of uterine cervix and breast, Treatment of, by radium and deep therapy X-ray, with 7-, 5-, and 3-year end-results, B. Hunt (abstract), 987.
- Cancer of uterus, Organization and efficiency in fight against, Cl. Regaud (abstract), 85.
- Cancer problem, Present status of, C. C. Little (abstract), 986.
- Cancer, prognosis in, Principles of, W. C. MacCarty (abstract), 460.
- Cancer treatments given without direct irradiation of heart: Far-reaching effects of gamma rays and short X-rays upon human heart, J. E. Gendreau (abstract), 802.
- [Cancer] Urinary bladder, Consideration of surgical procedures in treatment of malignant disease of, V. C. Hunt (abstract), 797.
- Cancer, What shall we teach public in regard to, and how shall we present it? D. T. Quigley, 369.
- Cancer, What should be done about it? H. J. Ullmann, 365.
- Cancer. *See also* Carcinoma, Malignancy, Tumor, etc.
- Canti film, 407.
- Canti, R. G., 407.
- Capp, Charles S., 982, 1000, 1012, 1024.
- Cappelli, Luigi, 806.
- Carbuncles and boils, Treatment of, by roentgen rays, E. T. Leddy and S. A. Morton (abstract), 411.
- Carbuncle, Renal, T. D. Moore (abstract), 1005.
- Carcinoma, bronchial, primary, Clinical manifestations of, E. H. Funk (abstract), 581.
- Carcinoma, buccal, radium treatment of, Principles of and some results in, G. E. Birkett (abstract), 590.
- [Carcinoma] Carcinomatous metastasis of bone, Value of roentgenotherapy in, A. Ratti (abstract), 414.
- Carcinoma, cervical, Pregnancy after radium therapy for: Cesarean hysterectomy at eighth month, G. B. Contardo (abstract), 1009.
- Carcinoma, cutaneous, Efficacy of radium therapy in advanced cases of, F. Perussia (abstract), 407.
- Carcinoma, diagnosis of, from blood serum, Some notes on, H. M. Jamieson (abstract), 584.
- Carcinoma, mammary, Deep roentgen-ray therapy of. II.—Five-year results: Value of method as auxiliary to surgical procedures in the operable and as a primary procedure in the inoperable cases, W. A. Evans and T. Leucutia (abstract), 812.
- Carcinoma, metastatic, to bone, 155-157, 172-175.
- Carcinoma, mice with, studies on (Maximum dose, fractional treatment, or saturation method?), J. Juul (abstract), 784.
- Carcinoma, Multiple X-ray, following psoriasis: Case report and comment, H. Goodman and C. W. Price (abstract), 818.
- Carcinoma of breast, Diagnosis and treatment of, W. C. White (abstract), 986.
- Carcinoma of breast, Radium treatment of primary, G. Keynes (abstract), 1015.
- Carcinoma of breast, Roentgen treatment of metastasis to vertebrae and bones of pelvis from, E. T. Leddy (abstract), 811.
- Carcinoma of cervix, microbial flora of, and their importance in radiotherapy, Study of, R. Vincent and O. Monod (abstract), 89.
- Carcinoma of cervix uteri, C. O. Bailey (abstract), 588.
- Carcinoma of cervix uteri, treatment of, Present status of, E. Zweifel (abstract), 584.
- See also* Carcinoma of uterine cervix and Carcinoma of uterus.
- Carcinoma of colon, Rôle of X-ray in diagnosis of, L. B. Morrison (abstract), 86.
- Carcinoma of lungs and bronchi, Primary, E. V. Goltz (abstract), 583.
- Carcinoma of lung, primary, notes on pathology of, W. Boyd (abstract), 87.
- Carcinoma of pylorus, early, Contribution to diagnosis of, H. Meyer-Borstel (abstract), 986.
- Carcinoma of rectum, Skeletal metastases from: report of eight cases, A. H. Aufses (abstract), 986.
- Carcinoma of skin, Cosmetic results of electrocoagulation and radium treatment, especially of, A. Buschke and L. Loewenstein (abstract), 807.
- Carcinoma of stomach, Early diagnosis of, L. G. Rigler (abstract), 998.
- Carcinoma of thymus, with extensive metastases, in new-born child, Case of, G. V. Bedford (abstract), 582.
- Carcinoma of tongue, Treatment of, M. Friedman (abstract), 587.
- Carcinoma of ureter, Primary, H. J. Lindner, R. D'Aunoy, and R. J. Mailhes (abstract), 583.
- Carcinoma of uterine cervix, Radiotherapy of, at Radium Institute of Paris, A. Lacassagne (abstract), 88.
- Carcinoma of uterine cervix, Rational treatment of, W. Long (abstract), 987.
- Carcinoma of uterus, body of, Treatment of, W. Neill, Jr. (abstract), 590.
- Carcinoma of uterus, Systemic changes in patients with, following roentgen and radium treatment, E. O. Gaessler (abstract), 89.
- Carcinomata [of uterus] treated with radium, Bacterial flora in, A. M. Bonanno (abstract), 407.
- Carcinoma patients, Diet of, W. Caspari (abstract), 587.
- Carcinoma, radiation therapy in, with fractional doses, Present methods and results of, L. Freund (abstract), 415.
- Carcinoma, radiation therapy of, Auxiliary methods in, H. Hirsch (abstract), 415.
- Carcinoma, radiation treatment of, Present methods

- of, and results (III): saturation method of Pfahler and Kingery, H. Holfelder (abstract), 589.
- Carcinomas, Roentgen diagnosis of inflammatory lesions of colon and their differentiation from, H. Pansdorf (abstract), 100.
- Carcinoma, treatment of, Modern methods in, F. B. Gurd (abstract), 585.
- Carcinoma, Uranium-thorium colloid in treatment of, G. T. Pack and F. W. Stewart (abstract), 591.
- Carlson, H. A., 995.
- Carman, Russell D., 484, 485, 619, 1007.
- Carnett, J. B., 690, 693.
- Carpenter, C. M., 711, 719, 736.
- Carter, Edgar B., 74.
- Carter, L. J., 44-46, 86, 87, 103, 105, 108, 402, 422, 426, 430, 564, 582, 587, 588, 590, 592, 593, 603, 604, 612, 790, 816, 817, 827, 829, 830, 944, 945, 981, 990, 1000, 1004, 1006, 1007, 1010, 1015, 1029.
- Carter, L. J., Further report on X-ray treatment of menorrhagia of menopause and uterine fibroids, 44-46. *See other references.*
- Carter, L. J., X-ray treatment of essential hematuria: case report, 944. *See other references.*
- Carter, Vandyck, 980.
- Carty, John R., 553, 571, 575, 587, 591, 611.
- Cary, N. Austin, 978.
- Casati, Annibale, 994.
- Case, James T., 37, 334, 335, 338, 620, 834, 974.
- Casellas, Pedro R., 92, 427.
- Casolo, G., 924.
- Caspari, W., 587.
- Castellani (cited), 417, 604, 605.
- Castellino, Pietro G., 817.
- Castle (cited by J. S. McLester), 100.
- Castleton, Kenneth B., 978.
- Cathalorda, J., 925.
- Caustics for cancer, 438.
- Cazanove (cited by W. W. Belden), 926.
- Cazzamali, P., 459.
- Cecum and ascending colon, Stasis of, L. D. Johnson (abstract), 618.
- Central New York Roentgen Ray Society, 563.
- Cerebral falx, Calcification of, G. Balestra (abstract), 818.
- Cerebral falx, Trauma and calcification of, G. Betoecchi (abstract), 423.
- Cerny (cited by R. N. Delitch), 377.
- Chadwick, Henry D., 433.
- Chaievitch, S. S., 427.
- Chalkley, H. W., 710, 718.
- Chamberlain, W. Edward, 4, 575.
- Chambers (cited by C. F. Geschickter), 145.
- Chaperon, C., 925.
- Chapin, H. A., 940.
- Charcot, Jean M., 983.
- Charles, Donald R., 710, 718.
- Chastenot de Géry, P., 927.
- Chaton, M., 924.
- Chauvion Chausier (cited by H. I. Teperson), 334.
- Chenault, H. Clay, 793.
- Chernosky, W. A., 810.
- Chesney, Alan M., 391.
- [Chest] Atelectasis, post-operative pulmonary: consideration of some factors in etiology, prevention, and treatment, H. Brunn and S. Brill (abstract), 607.
- [Chest] Congenital pneumothorax: review of literature and report of case, J. Stein (abstract), 92.
- [Chest] Empyema perforating into bronchus, Posterior mediastinal, Q. Vischia (abstract), 95.
- [Chest] Fibrinous pneumonia, with partial lobar consolidation, M. Viamonte (abstract), 92.
- Chest in rachitic children: roentgenologic study, R. S. Bromer (abstract), 989.
- Chest, lateral, clinical and roentgenologic value of, C. H. Warfield (abstract), 600.
- Chest, Localized pneumothoraces as cause of annular shadows in roentgenograms of, W. P. Warner (abstract), 601.
- [Chest] Lymphangitis, carcinomatous pulmonary, Contribution to diagnosis of, E. Lucas and H. Pollack (abstract), 87.
- Chest of new-born infant, Roentgen appearance of, J. T. Farrell, Jr. (abstract), 94.
- [Chest] Phrenicectomy on pulmonary cavitation, Effect of, W. I. Werner and E. J. O'Brien (abstract), 606.
- [Chest] Post-operative pulmonary hypoventilation, R. H. Overholt (abstract), 605.
- [Chest] Pulmonary suppuration, Internal drainage, its application in, W. B. Faulkner (abstract), 607.
- [Chest] Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, Eugene Freedman, 14-29.
- Chiari (cited by J. F. Le Cocq), 977.
- Child, Charles M., 336, 338.
- Child Research Council, University of Colorado Medical School, 499.
- Childhood, Intravenous urography in diagnosis of urological diseases of, A. Hyman (abstract), 105.
- Children, Acute ulcerations of stomach in, B. R. Shore (abstract), 614.
- Childs, Donald S., 59-64, 83, 105, 106, 109, 614, 792, 832, 974.
- Childs, Donald S., Tumor involving lymphoid tissue, 59-64. *See other references.*
- Chipault (cited by A. Steindler), 983.
- Chizzola, Giuliano, 96, 98.
- Cholecystitis, acute experimental, effect of, on emptying of gall bladder, G. T. Murphy (abstract), 97.
- Cholecystitis and cholecystography, H. Smith (abstract), 612.
- Cholecystographic diagnosis of papillomas of gall bladder, B. R. Kirklin (abstract), 786.
- Cholecystography: analysis after 6½ years' application, S. Moore (abstract), 612.
- Cholecystography, Biliary colic in routine, I. Gray and M. J. Matzner (abstract), 97.
- Cholecystography by means of oral administration of dye, B. Thom (abstract), 786.
- Cholecystography, Cholecystitis and, H. Smith (abstract), 612.
- [Cholecystography] Gall-bladder visualization in jaundiced patients, H. Rudisill (abstract), 786.
- Cholecystography, Intravenous, and liver function determination: clinical and roentgenological values, S. R. Miller and C. A. Waters (abstract), 785.
- Cholecystography: review of 34 cases, with operative findings, D. B. Harding (abstract), 995.
- Chondrodysplasia, hereditary deforming, 162.
- Chondromas, 158, 159, 182, 237, 247.
- Chondromatosis of joints, Contribution to, Hofmann (abstract), 581.
- Chondromyxoma, 211.
- Chondromyxosarcoma, 251.
- Chondromyxosarcoma, secondary, 145.
- Chondrosarcoma of os calcis, 240.
- Chondrosarcoma, primary, 119, 124.
- Chondrosarcoma, secondary. *See Myxosarcoma.*
- Christen, Half value layer meter of, in new form, H. T. Schreus (abstract), 571.
- Christen (cited by M. M. Schwarzschild), 861.

- Christensen, F. C., 50, 244.
 Christian, S. L., 638, 644, 653.
 Christian's syndrome, 414.
 Christie, Ronald V., 707, 709, 710, 717, 718.
 Chromium trichloride, Structure of, N. Wooster (abstract), 783.
 Chubb, L. W., 893.
 Chute (cited by G. S. Foulds), 1003.
 Clairmont, P., 14, 28.
 Clap, L., 924.
 Clark, George L., 76, 322, 326, 327.
 Clark, Harry, 327.
 Clark, Jefferson H., 833.
 Clark, J. H., 52, 58.
 Clark, W. C., 627.
 Clarkson, Wright, 491, 813.
 Clavicle, Lesions of, H. S. Anderson, 181.
 Clement, Gage, 73.
 Cleveland clinic, 589.
 Clifton, Harry C., 270.
 Clinical Orthopedic Society, 921.
 Clinton, W. R., 65.
 Cloud, Albert W., 690, 693.
 Clough, S. DeWitt, 75.
 Cluzet, —, 960.
 Coates, H. W., 827.
 Coblenz, W. W., 736, 737, 743, 836, 838.
 Codman, E. A., 664, 694.
 Coe, F. O., 814.
 Coffey, Robert C., 89.
 Cogswell, Samuel, 761, 763, 764.
 Cohen, Joseph, 402.
 Cohn, L. Clarence, 182, 187-197, 215, 246.
 Cohn, L. Clarence, Non-suppurative osteomyelitis, 187. *See other references.*
 Cohn, Max, 417.
 Cohn, Willi M., 780.
 Colby, Fletcher H., 104.
 Cole, Lewis Gregory, 961.
 Cole, Wallace H., Final report on case of bone cyst of patella, 752.
 Coley, Bradley L., 581, 627, 636, 637, 648.
 Coley, William B., 145, 179, 627-656.
 Coley, William B., Endothelial myeloma or Ewing's sarcoma, 627. *See other references.*
 Coley's serum (or toxins), 203, 208, 627-656, 671-673, 677.
 Colic, Biliary, in routine cholecystography, I. Gray and M. J. Matzner (abstract), 97.
 Colitis, chronic, Radiological aid in study of, A. Gavazzeni (abstract), 100.
 Colitis, ulcerative, and bloody diarrhea, Psychogenic factors in etiology of, C. D. Murray (abstract), 616.
 Colitis, ulcerative, contribution to roentgenologic diagnosis of: Roentgenologic demonstration of mucosa by means of umbrathor, H. Regelsberger (abstract), 95.
 Colitis, ulcerative, roentgenologic diagnosis of, Contribution to, H. J. Teschendorf (abstract), 622.
 Coll de Carrera (cited by W. W. Belden), 929.
 Colla, C., 596.
 Colle, Guido, 924.
 Colleu, Paul, 925.
 Collins, J. N., 772.
 Collins (cited by R. H. Jamieson and F. Hernaman-Johnson), 810.
 Colographic, double contrast, studies of ileocecal tuberculosis, 432.
 Colon, ascending, Stasis of cecum and, L. D. Johnson (abstract), 618.
 Colon, carcinoma of, Role of X-ray in diagnosis of, L. B. Morrison (abstract), 86.
 [Colon] Colonic diverticula, Roentgenological aspect of various types of, W. O. Upson and A. E. MacGregor, 30-37.
 Colon, consideration and cure of, Present, J. A. Lichty (abstract), 1000.
 Colon, inflammatory lesions of, and their differentiation from carcinomas, Roentgen diagnosis of, H. Pansdorf (abstract), 100.
 Colon, Irritable, J. Muir (abstract), 616.
 Colon studies: VI.—Cecal stasis: clinical significance and relation to proximal colon stasis, J. L. Kantor, S. Schechter, and J. A. Marks (abstract), 101.
 Colon, tumors of, and non-recognized invagination of tumor, Forcing demonstration of canalization in, A. W. Fischer (abstract), 830.
 Colon. *See also under* Intestines.
 Color changes produced by roentgen rays in some aqueous solutions: considered for dosage measurements and for detection of effects of radiation on other chemical compounds, W. Stenstrom and A. Lohmann, 322.
 Colvin, Alexander R., Bone cysts, 683.
 Colwell, N. P., 729.
 Compere, Edward L., 1016.
 Compton, Arthur H., 302, 305, 361, 473, 474, 523.
 Conklin, C. B., 391.
 Conley, Arthur H., 82.
 Conner, H. Milton, 485.
 Connor, Charles L., 179, 639, 643, 655, 985.
 Contrado, G. B., 1009.
 Conte, Ettore, 406, 416, 837.
 Cooley, F. H., 599.
 Coolidge, W. D., 703.
 Cooper, John E., 334, 335, 338.
 Cooper, T. Valentine, 827.
 Cooperman, Morris B., 924.
 Copeland, Murray M., 153, 159, 179, 180, 182, 185, 198-210, 214, 215, 220, 223, 283, 287, 649, 667, 678, 679, 828.
 Copeland, Murray M., Bone metastases: study of 334 cases, 198. *See other references.*
 Copher, Glover H., 478.
 Cordes, E., 244.
 Cork, J. M., 593.
 Corning (cited by Eugene Freedman), 14, 15.
 Cornu (cited by H. Seemann), 780.
 Coryllos (cited by H. Brown and S. Brill), 608.
 Costantini (cited by W. W. Belden), 924.
 Coster, D., 780.
 Costolow, William E., 90, 558.
 Cottalorda, J., 924.
 Cotton, Frederic J., 577, 657-659.
 Cotton, Frederic J., Osteitis fibrosa, 657. *See other reference.*
 Coues, W. P., 234, 242.
 Coulaud, E., 52, 58.
 Coulter, John S., 737-744, 926.
 Coulter, John S., and Smith, Edwin M., Jr., Clinical applications of ultra-violet rays, 737.
 Coureand (cited by W. W. Belden), 924, 926.
 Courville, Cyril B., 818.
 Coutard (cited by A. Kahlstorf and A. Zuppinger), 812.
 Couturat (cited by W. W. Belden), 925.
 Covell, W. P., 336, 339.
 Cramer, H., 412.
 Crane, Jay J., 105.
 Craver, Lloyd F., 58, 813, 1018.
 Crespellani, Carlo, 404.
 Creyssel, Jean, 924.
 Crile, George W., 627, 643.
 Crocker Laboratory, New York, 300.
 Crockett, R. H., 812.

- Crothers, Bronson, 423.
 Crowther, J. A., 783.
 Crowther, J. C., 302.
 Cruveilhier (cited by E. Devic, P. Savy, and E. Freedman), 25.
 Crystal lattice of iron silicide, FeSi, H. Möller (abstract), 594.
 Crystals, naphthalene and anthracene, Orientations of molecules in, N. Banerjee (abstract), 593.
 Crystal structure, Classification system of the silicates based upon, St. v. Náray-Szabó (abstract), 782.
 Crystal structure of cadmium chloride, L. Pauling and J. L. Hoard (abstract), 595.
 Crystal structure of cementite, S. B. Hendricks (abstract), 597.
 Crystal structure of Fe_2P , Fe_2N , Fe_3N , and FeB , S. B. Hendricks and P. R. Kosting (abstract), 597.
 Crystal structure of normal paraffins, S. H. Piper and T. Malkin (abstract), 596.
 Crystal structure of normal paraffins at temperatures ranging from that of liquid air to melting points, A. Müller (abstract), 596.
 Crystal structure of silver cyanide, H. Braekken (abstract), 593.
 Crystalline structure of hydrogen sulfide and hydrogen selenide (II), G. Natta (abstract), 595.
 Crystalline structure of rubidium azide, L. Pauling (abstract), 779.
 Cubbins, William R., 82.
 Cumberbatch, Elkin P., 965.
 Cumming, Hugh S., 391.
 Cumming, Robert E., 1007.
 Cunningham, Daniel J., 507.
 Cunningham, Lester W., 485, 924.
 Coquelet, Oct., 924.
 Curie Institute, Paris, 299, 573.
 Curie, Mme., 960.
 Cutler, Max, 891.
 Cutter, William D., 75.
 Cyriax, Edgar F., 924.
 Cystic duct, double, Double gall bladder with, R. Hayes, 66.
 Cysts, bone, 129, 131, 134, 157, 182, 214, 237, 248, 283, 683.
 Cysts, Bone, Alexander R. Colvin, 683.
 Cyst, dental root, 218.
 Cyst, dentigerous, 220.
 Cysts, dermoid, and splenic calcifications, Discussion of opaque formations in abdomen with special regard to, A. Vallebona (abstract), 828.
 Cysts of long bones of hand and foot, H. Platt (abstract), 984.
 Cysts, renal, Solitary serous, with study of roentgen observations, R. Herbst and W. J. Vynalek (abstract), 1008.
 Czerny, Vincenz, 480, 482.
 Dale, T., 575.
 Dall'Acqua, Virgilio, 99.
 Daly, Joseph, 855.
 Dandy, Walter E., 819, 1024.
 Danforth, R. S., 732, 736.
 Dann, David S., 402.
 Darbois, P., 927.
 Darier-Roussy sarcoid, 328.
 Darnell, Carl, 711.
 D'Arsonval, A., 708, 718, 1015.
 Daugherty, Robert L., 352.
 D'Aunoy, Rigney, 583, 830.
 Dautwitz, Fritz F., 810.
 Danvillier, A., 3, 4, 8, 39, 703.
 Davidson, William B., 603.
 Davies, Morriston, 602.
 Davis, George G., 162, 179, 924.
 Davis, Leon, 833.
 Deal, Don W., 924.
 Deaver, John B., 646.
 de Broglie (cited by S. Bhargava), 595.
 Debye, P., 780.
 De Jardin (cited by H. W. Wiese), 480, 482.
 Dekker (cited by W. W. Belden), 925.
 Delaware, Medical Society of, 75.
 Del Buono, Pietro, 703.
 Delchef (cited by W. W. Belden), 925.
 De Lee, Joseph B., 334, 335, 338.
 Delherm (cited by W. W. Belden), 925.
 Delitch, R. N., 377.
 Delprat, Jessie P., 824.
 Delsasso, Leo P., and Warner, Arthur H., Rugged, direct-reading iontoquantimeter of high sensitivity, 39-43.
 De Nobele (cited by F. C. Wood and G. M. MacKee), 704.
 Dermatitis herpetiformis, Spinal roentgen-ray therapy in, H. R. Foerster (abstract), 410.
 Dermatologic therapeutics: basic principles and technic, M. Scholtz (abstract), 421.
 Dermatology, Roentgen therapy in, IX (Principles of roentgenotherapy), E. A. Pohle (abstract), 419.
 Derr, John S., Epithelioma on bridge of nose: case report, 955.
 Desfosses (cited by W. W. Belden), 925.
 Desjardins, Arthur U., 73, 412, 565, 831, 968, 1018.
 Dessauer, Friedrich, 77, 969.
 Destot (cited by G. Rotolo), 576.
 Detroit Roentgen Ray and Radium Society, 392.
 De Vecchi, Luigi, 400.
 Devic, E., 25, 28.
 Devrient, William, Thyssen, Stephen, and Sokoloff, Boris, Migration of epinephrin in new apparatus for electro dialysis, 746.
 Dewis, John W., 270.
 DeWitt, C. H., 96, 104, 427, 584, 600, 616, 621, 826, 975, 1027, 1028.
 Diaphragm: clinical and roentgenological study, R. Pomeranz (abstract), 991.
 Diaphragm for complete elimination of secondary radiation, New, A. L. Soresi, 486.
 Diaphragm, position and activity of, Air in peritoneal cavity: effect on, R. H. Overholt (abstract), 994.
 Diaphragm, Post-operative behavior of, K. D. A. Allen, 492.
 Diaphragmatic hernia, Right, M. J. Geyman, 483.
 Diaphragmatic hernia, roentgenologic diagnosis of, Progressive in, A. B. Moore and B. R. Kirklin (abstract), 609.
 Diaphragmatic hernia, Very large, P. Eichler (abstract), 610.
 Diarrhea, bloody, Psychogenic factors in etiology of ulcerative colitis and, C. D. Murray (abstract), 616.
 Diathermy, dementia paralytica, with hyperpyrexia produced by, Treatment of, C. A. Neymann and S. L. Osborne (abstract), 993.
 Diathermy, Experiments with, 705.
 Diathermy in diagnosis, Use of, J. Arendt (abstract), 993.
 Diathermy in treatment of diseases of genito-urinary tract, Present status of electrosurgery and, A. G. Fleischman (abstract), 797.
 Dickey, Lloyd B., 1029.
 Dickson, B. R., 1021.
 Dickson, W. H., 480, 482.
 Diessl, Fritz, 925.

- Diet in chronic gastric ulcer (abstract), 622.
 Diet of carcinoma patients, W. Caspari (abstract), 587.
 Dioulafoy (cited by E. Devic, P. Savy, and E. Freedman), 25.
 Dillingham, Frederick H., 179.
 Diss, A., 928.
 Diverticula, colonic, Roentgenological aspect of various types of, W. O. Upson and A. E. MacGregor, 30-37.
 Diverticulum, Epibronchial, of esophagus in patient affected by gastric neoplasm, M. Muzii (abstract), 96.
 Diverticula of duodenum and of structures resembling such diverticuloids, Roentgenologic appearance of, R. Sandera (abstract), 102.
 Diverticula of thoracic portion of esophagus, C. H. Heacock (abstract), 96.
 Diverticula of urinary bladder in women: report of cases, J. J. Crane (abstract), 105.
 Diverticulitis of cecum, Solitary, A. Stewart (abstract), 996.
 Diverticulitis of colon, with special reference to acute perforations of sigmoid, R. W. Whitman (abstract), 997.
 Doan, Charles A., 803.
 Doan, Gilbert E., 461; joint-author, 508.
 Dodds, E. C., 938, 940.
 Donaldson (cited by K. Wilson), 807.
 Donaldson, Malcolm, 408.
 Donaldson, S. W., 384, 430, 959-961.
 Donaldson, S. W., Legal suggestions (editorial), 959.
 Dondale, M., 710, 718.
 Doornkaat-Koolman, Menna ten, 404.
 Dorcas, M. J., 736, 836.
 Dorland, W. A. N., 339, 562.
 Dorland, W. A. Newman, Rôle of radiography in maternity care (editorial), 562. *See other reference.*
 Dorneich, M., 811.
 Dorno, C., 736, 806.
 [Dosage] Depth effect and elective action on tissue produced by short electrical waves, E. Schliephake (abstract), 973.
 Dosage of ultra-violet radiation in infants with tetany, H. Bakwin and R. M. Bakwin (abstract), 834.
 Dosimeter, ultra-violet, Principles of new, E. Weyde (abstract), 837.
 Dott (cited by G. Sighinolfi), 103.
 Doub, Howard P., 97, 101, 102, 329, 330, 332, 335, 338, 424, 572, 581, 606, 764-766, 792, 819, 829, 831, 833, 834, 929, 930, 931, 986, 990, 994.
 Doub, Howard P., useful position for examining foot, 764. *See other references.*
 Downes, Helen R., 327.
 Drach, Edmund L., 75.
 Draper (cited), 98, 616.
 "Drill bone," 144.
 Driver (cited by H. R. Foerster), 410.
Drosophila eggs as used in Crocker Laboratory, 300, 553, 611, 698.
 Duane, William, 4-8, 11-13, 39-41, 43, 303, 305-307, 315-320, 868, 894.
 Duboucher (cited by W. W. Belden), 924.
 Duca, A., 335, 338.
 Ducts, urinary, Examination of, with new substance intravenously injected, D. Tartagli (abstract), 104.
 Duff, John, 795.
 Duffy, James J., 883, 890.
 Dufour, Henri, 925.
 Dufresne, Eng., 1025.
 Duhem (cited by W. W. Belden), 927.
 Dujarier, Ch., 925.
 Dumarest, —, 968.
 Dunham, E. K., 628, 653.
 Duodenum and terminal ileum, Hyperplastic tuberculosis of, J. D. Garvin (abstract), 825.
 Duodenum, chronic stenosis of, Contributions to study of, R. Appelmans, F. Van Goidsenhoven, and J. Boine (abstract), 1000.
 Duodenum, diverticula of, and of structures resembling such diverticuloids, Roentgenologic appearance of, R. Sandera (abstract), 102.
 [Duodenum] Duodenal drainage, radiological control on, Importance of, G. Chizzola (abstract), 98.
 [Duodenum] Duodenal fistula, J. J. Gilbride (abstract), 102.
 [Duodenum] Duodenal mobility, Radiological aspects of, V. Dall'Acqua (abstract), 99.
 [Duodenum] Duodenal ulcer, Evaluation of X-ray examination in, C. D. Enfield (abstract), 101.
 [Duodenum] Duodenal ulcer, Radiological diagnosis of, A. Anzillotti (abstract), 98.
 Duodenum, screen examination of, Concerning method of, N. Ratkóczy (abstract), 102.
 Duodenum, submesocolic portion of, Stenosis of, V. Potenza (abstract), 98.
 [Duodenum] Mesenterium commune, Diagnosis of, T. Weiss (abstract), 932.
 Duodenum, ulcer of extra-bulbar portion of, Contribution to knowledge of, R. Viviani (abstract), 615.
 Durham, O. C., 74.
 Dvorak, H. J., 995.
 Dyes, Otto, 832.
 Dyke, Cornelius G., 424, 818, 819.
 Dystrophy, juvenile bone, 163.
 Eastman Kodak Company, 346, 352, 517.
 Eastmond, Charles, 73.
 Ebersson, Frederick, 824.
 Economic aspect of radiation, 299.
 Eczema, chronic, 420.
 Edberg, Einar, 617.
 Eddington, A. S., 719.
 Eddy, Walter H., 836.
 Eerland (cited by H. Naujoks and H. I. Teperson), 334, 338.
 Effusion in thorax, encapsulated, Roentgenological appearance of interlobar and mediastinal, E. Freedman, 14-29.
 Eglin, J. M., 523.
 Ehrenfried, Albert, 179.
 Ehrich, Wilhelm, 718.
 Ehrmann, R., 99.
 Eichenlaub, F. J., 345.
 Eichler, P., 610.
 Einhorn (cited by M. Behrend), 621.
 Electrocoagulation, Cosmetic results of, and radium treatment, especially of carcinoma of skin, A. Buschke and L. Loewenstein (abstract), 807.
 Electrocoagulation of warts, 343, *et seq.*
 Electrodesiccation *versus* radiotherapy in treatment of basal-cell epithelioma of skin, G. Archambault and A. Marin (abstract), 422.
 Electrodialysis, apparatus for, Migration of epinephrin in new, William Devrient, Stephen Thyssen, and Boris Sokoloff, 746.
 Electrosurgery and diathermy in treatment of diseases of genito-urinary tract, Present status of, A. G. Fleischman (abstract), 797.
 Elements, Lattice constants of, W. Hume-Rothery (abstract), 781.
 Eley, R. Cannon, 423.

- Eller, J. J., 703.
 Eller (cited by R. H. Stevens), 439.
 Ellinger, Ph., 410.
 Elliott, Simeon, 796.
 Ellis, C., 509, 512, 513.
 Ellis, John D., 839.
 Elsom, J. C., 729.
 Emery, E. S., Jr., 480, 482, 787.
 Emphysema and atelectasis, Mechanism of physical signs in neoplastic and other diseases of lung, with especial reference to, C. Jackson (abstract), 93.
 Empyema, chronic, Bone changes in case of, T. Dale (abstract), 575.
 Empyema, posterior mediastinal, perforating into bronchus, Q. Vischia (abstract), 95.
 Encephalography for diagnosis and therapy of infantile paralysis, Importance of, L. Guttman (abstract), 422.
 Encephalography in cases with fixed lesions of brain, B. Crothers, E. C. Vogt, and R. C. Eley (abstract), 423.
 Encephalography, Indications and contra-indications of, and ventriculography, E. P. Pendergrass (abstract), 1024.
 Encephalography, Technic of, C. D. Camp and R. W. Waggoner (abstract), 818.
 Endometriosis rectovaginalis treated successfully by roentgen rays, Case of, J. Heyman (abstract), 416.
 Enemata: from anatomical and physiological standpoints, S. A. Lewis (abstract), 787.
 Enfield, Charles D., 101.
 Engel (cited by R. Kienböck and E. Markovits), 83.
 Engler, C. W., 25.
 Epilepsy, traumatic, and its rationale, Radical treatment of, W. Penfield (abstract), 425.
 Epiphyseal necroses, 578.
 Epiphyses of femora, Concerning unusual changes in, described by Kreuz, Ernst Freund (abstract), 84.
 Epiphysitis of hip joint, Acute transient, O. L. Miller (abstract), 981.
 Epithelioma, adamantine, 219.
 Epithelioma of lip, Radium treatment of early, H. Hailey (abstract), 807.
 Epithelioma of skin, basal-cell, Electrodesiccation versus radiotherapy in treatment of, G. Archambault and A. Marin (abstract), 422.
 Epithelioma on bridge of nose: case report, J. S. Derr, 955.
 Eppinger (cited by M. J. Geyman), 484.
 Epstein, Berthold, 25, 26, 28.
 Epstein, Julius, 210.
 Epstein, Stephan, 836.
 Ergosterol, irradiated, Effect of, on healing of experimentally produced fractures in animals, H. A. Swart (abstract), 577.
 Ergosterol, irradiated, Radiographic studies on healing of experimentally produced fractures followed by administration of, J. Morelle (abstract), 982.
 Erickson, L. G., 73.
 Erysipelas, treatment of, by X-rays with account of three cases, Note on, R. H. Jamieson and F. Hernaman-Johnson (abstract), 810.
 Erythema and pigmentation in skin, Influence of air pressure on formation of, F. Schmidt-Labaume and E. Uhlmann (abstract), 421.
 Esau (cited by E. Schliephake), 973.
 Esophagus, Cancer of: analysis of 82 cases, E. P. McCullagh (abstract), 589.
 Esophagus, Diverticula of thoracic portion of, C. H. Heacock (abstract), 96.
 Esophagus, Epibronchial diverticulum of, in patient affected by gastric neoplasm, M. Muzii (abstract), 96.
 Esophagus, Lower, and upper portions of stomach as seen by roentgenologic examination, J. Palugyay (abstract), 996.
 Esophagus, Radium therapy in cancer of nose, larynx, and, H. M. Moran (abstract), 808.
 Esophagus, stenotic affections of, New technic for radiological study of, G. Chizzola (abstract), 96.
 Estey, Roger S., 836.
 Ethmoid, Malignant tumor of, J. E. Habbe, 548.
 Eusterman, George B., 789, 855.
 Evans, William A., 812.
 Eve, A. S., 465.
 Ewerhardt, F. H., 729.
 Ewing, James, 179, 207, 627, 636-641, 643, 647, 648, 652-654, 664, 967.
 Ewing's sarcoma, Endothelial myeloma or, W. B. Coley, 627.
 Ewing's sarcoma, Report of patient with, E. E. Larson, 556.
 Ewing's sarcoma. *See* Sarcoma, Ewing's.
 Exostoses, Congenital, and their transformation into osteochondromas, Mosenthal (abstract), 85.
 Exostoses, 112-117, 162, 211, 235, 247.
 Eye, Effect of roentgen rays on, W. Rohrschneider (abstract), 813.
 Eye, Effect of visible light, infra-red and ultra-violet rays on, W. Hoffmann (abstract), 836.
 Eyes, Skin diseases about, R. Fields (abstract), 420.
 Eymer, H., 417.
 Eymer (cited by E. Zweifel), 585.
 Fabricius-Moeller (cited by Krebs, C., Rask-Nielsen, H. C., and Wagner, A.), 565.
 Fabry, Ch., 835.
 Faerber (cited by L. B. Dickey), 1029.
 Faessler, A., 779.
 Fahlenbock, W., 234, 242.
 Fahr, George E., 73.
 Fahrney, H. L., 955.
 Failla, G., 2, 4-6, 8-12, 310, 317, 967.
 Faldini, G., 925.
 Faldino, Giulio, 925.
 Fales, L. H., 603.
 Fansler, W. A., 624.
 Faraday (cited), 1015.
 "Farmer's skin," 436.
 Farnell, Frederic J., 423.
 Farnsworth, S. W., 893.
 Farr, Charles E., 944.
 Farrar (cited), 585.
 Farrell, John T., Jr., 94.
 "Fasting treatment" of roentgen and radium ulcers, 941.
 Fauley (cited), 623.
 Faulkner, William B., 607.
 Fay, Temple, 423.
 Fayer (cited by A. L. Soresi), 491.
 Feci, Lorenzo, 823.
 Feet and hands, Ringworm of, W. A. Osborne (abstract), 420.
 Feet, bones of hands and, An X-ray and clinical study of, Max Kahn, 211.
 Feigenbaum, J., 1010.
 Feil, André, 925.
 Felderman, Leon, 392.
 Femora, epiphyses of, Concerning unusual changes in, described by Kreuz, E. Freund (abstract), 84.
 [Femur] Femoral epiphysis, lower, Slipping of, J. J. Kurlander (abstract), 981.
 Femur, Fracture of neck of, end-results in 86 cases, J. C. Wilson (abstract), 83.

- [Femur] Hip joint, epiphysitis of, Acute transient, O. L. Miller (abstract), 981.
- Femur, subacute osteomyelitis of, resembling sarcoma, Report of five cases of, G. A. Stewart, 271.
- Femur, upper, Lesions of, G. T. Thompson, 278.
- Fenger, Christian, 785.
- Fenn, Wallace, 745.
- Ferguson, J. H., 61.
- Ferrari, A., 596.
- Ferrari, P., 925.
- Ferrata, A., 395.
- Ferrier, L., 927.
- Fibroids, Therapy of, and hemorrhagic metropathy in women's clinic at University of Würzburg, 1923-28, P. Uebel (abstract), 801.
- Fibromas, central, 221.
- Fibrosarcoma, periosteal, 141-143, 149-151.
- Fields, Russell, 420.
- Figi, Frederick A., 985.
- Findlay, G. M., 836.
- Findley, Palmer, 987.
- Fineman, Solomon, 484, 485.
- Fingers, bone lesions of, infective, Conservatism in treatment of, L. H. McKim (abstract), 981.
- Finkelstein, Reuben, 620.
- Finnerud, C. W., 329, 331, 333.
- Finney, Sr., J. M. T., 266.
- Finsen, N., 1015.
- Fiorentini (cited by O. M. Walters, B. J. Anson, and A. C. Ivy), 52, 57.
- Fischel, Karl, 1030.
- Fischer, A. W., 95, 101, 622, 830, 972.
- Fischer, Louis, 78.
- Fischer (cited by H. H. Berg), 999.
- Fischer-Wasels (cited by H. Hirsch), 415.
- Fisher, Hart E., 740, 743.
- Fisher, L. F., 772.
- Fistula, Duodenal, J. J. Gilbride (abstract), 102.
- Fitts, John B., 616.
- Fitzgibbon (cited), 972.
- Flajani-Basedow's disease, Alimentary tract in, P. Ottonello (abstract), 101.
- Flatau (cited by E. Zweifel), 585.
- Flecker, H., Elimination of dark room in photography, especially as applied to roentgenology, 381.
- Fleischman, Abraham G., 797.
- Fleischner, Felix, 16, 20, 28, 329, 330, 333.
- Flesher, Roy E., 891.
- Flipo (cited by W. W. Belden), 927.
- Fluoroscopic-radiographic change switch, R. B. Taft, 558.
- Foà, Arrigo, 407.
- Focal spot projection and position of X-ray tube in radiography, P. M. Andrus and A. Hambleton, 869.
- Foerster, Harry R., 410.
- Fogelson, Samuel J., 1001.
- Foot, bone of, Bilateral vesalanium, D. Agati (abstract), 82.
- Foot, long bones of, Cysts of, and hand, H. Platt (abstract), 984.
- Foot, Useful position for examining, Howard P. Doub, 764.
- Foot, warts and calluses on, 341.
- Foot, John A., 391.
- Forbus, W. D., 256, 270.
- Ford, Frances A., Irradiation therapy in functional ovarian disorders, 936.
- [Foreign body] bone, Pork, in bronchus simulating pulmonary tuberculosis, C. D. Sneller (abstract), 988.
- Foreign body, long retained, of unusual size, Report of, C. D. Holliger and F. B. Sheldon, 952.
- Foreign bodies in air and food passages, Observation in 50 cases of, E. G. Gill (abstract), 611.
- Foreign bodies, intra-ocular, missed: report of cases, B. J. Powell (abstract), 612.
- [Foreign bodies] Molar tooth in left lower bronchus, D. H. Ballon (abstract), 612.
- Forestier, J., 928.
- Forsdike, Sidney, 799.
- Forssell, Gösta, 86, 102, 586, 833, 932.
- Förster, Walter, 925.
- Fortescue, C., 893.
- Foster, G. S., Adenocarcinoma of breast: Case report: Six-year interval following amputation of breast—final general osseous metastasis, 759.
- Foulds, Gordon S., 1003.
- Fox, Charles M., 82.
- Fraas (cited by W. W. Belden), 925.
- Fractures, healing of experimentally produced, followed by administration of irradiated ergosterol, Radiographic studies on, J. Morelle (abstract), 982.
- Fractures in animals, experimentally produced, Effect of irradiated ergosterol on healing of, H. A. Swart (abstract), 577.
- Fractures of acetabulum, W. R. Cubbins, A. H. Conley, and J. J. Callahan (abstract), 82.
- Fracture of neck of femur: end-results in 86 cases, J. C. Wilson (abstract), 83.
- Fracture of neck of femur in nonagenarian, Recovery from, R. C. Webb (abstract), 577.
- Fractures of os calcis, G. Rotolo (abstract), 576.
- Fracture, Pathologic, E. D. Weinberg, 282.
- Fractures, Pathological, in primary bone tumors of extremities, B. L. Coley and G. S. Sharp (abstract), 581.
- Fragilitas ossium. See Bone fragility.
- Fraikin (cited by W. W. Belden), 925.
- Frank, Josef, 703.
- Franke, H., 353, 357.
- Fränkel, Walter K., 925.
- Frankfort, University of, Medical Clinic, 967.
- v. Franque (cited by E. Zweifel), 585.
- Fray, Walter W., 403.
- Freedlander, S. O., 17, 19, 23, 28.
- Freedman, Eugene, Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, 14-29.
- Freedmann, Joseph, 50.
- Freiburg, University of, Standardization apparatus of Radiological Institute of, E. Albrecht (abstract), 973.
- Freid, Jacob R., 691, 693.
- French hospitals, post-graduate courses in English in, 962.
- Freudenberg (cited by F. C. Wood and G. M. MacKee), 704.
- Freund, Ernst, 84.
- Freund, Etelka, 703.
- Freund, Leopold, 415, 1013.
- Frey, Sigurd, 445, 446, 459.
- Freye, —, 417.
- Fribourg-Blanc (cited by W. W. Belden), 926.
- Fricke, Hugo, 7, 322, 324, 327.
- Fricke, R. E., 210.
- Friebel, Paul, 244.
- Fried (cited), 582, 811.
- Friedenwald, Julius, 98.
- Friedman, J. C., 625.
- Friedman, Leo S., 429.
- Friedman, Milton, 587.
- Friedrich, W., 312, 316.
- Frigyér, L., 423.
- Fritsch, G., 799.
- Frobisher, J. H. M., 925.

- Froude, James A., 841.
 Fuhs, Herbert, 702, 703.
 Fukase, Shuichi, 445, 446, 459, 840.
 Fullerton, Andrew, 270.
 Fungoides, mycosis, Genetic neoplastic relationships of Hodgkin's disease, aleukemic and leukemic lymphoblastoma, and, A. S. Warthin (abstract), 803.
 Funk, Elmer H., 581.
 Fürst, Walter, 575.
 Gabriel, Gerhard, 703, 704, 791.
 Gaertner, Otto, 703.
 Gaessler, E. O., 89.
 Gál, Felix, 400.
 Gall bladder, Blood supply of, A. Rubascheva (abstract), 97.
 Gall bladder, Double, with double cystic duct, R. Hayes, 66.
 Gall bladder, emptying of, Effect of acute experimental cholecystitis on, G. T. Murphy (abstract), 97.
 Gall bladder, sarcoma of, Primary, A. Brunschwig (abstract), 995.
 Gall-bladder visualization in jaundiced patients, H. Rudisill (abstract), 786.
 Galland, Marcel, 1025.
 Gallant, Alfred E., 925.
 Galli, Giuseppe, 407.
 Gallstone, calcified, in child seven years old, X-ray visualization of, H. Rudisill, Jr., 942.
 Gallstones in ampulla of Vater, E. S. Judd and J. M. Marshall (abstract), 785.
 Gamma rays and short X-rays upon human heart, Far-reaching effects of: Electrocardiographic results of cancer treatments given without direct irradiation of heart, J. E. Gendreau (abstract), 802.
 Gamma rays, Biological effects of, W. G. Whitman and M. A. Tuve (abstract), 1015.
 Gamma rays, radiography by, Technic of, C. S. Barrett, R. A. Gezelius, and R. F. Mehl, 461.
 Gamma rays, Radiography by use of, R. F. Mehl, G. E. Doan, and C. S. Barrett, 508.
 Garcin, J., 925.
 Garland, L. H., joint author, 679.
 Garré (cited by L. C. Cohn), 187, 188.
 Garré's non-suppurative osteitis. *See* Osteitis, Garré's non-suppurative.
 Garvin, John Day, 825.
 Gary, W. E., 808.
 Gastrectomy, Subtotal, for duodenal ulcer: ten years' experience and clinical end-results, A. A. Strauss, L. Bloch, J. C. Friedman, J. Meyer, and M. L. Parker (abstract), 625.
 Gastritis, Gastric ulcer with, in 10-year-old child, F. Herz (abstract), 620.
 Gastritis, Segmentary toxic, of antrum pylori, L. Giuntoli (abstract), 97.
 Gastro-intestinal disorders, Human constitution in relation to, J. Friedenwald (abstract), 98.
 Gastro-intestinal tract of starving rats, motility of, Observation on, L. J. Menville, J. N. Ané, and S. N. Blackberg (abstract), 998.
 Gastro-intestinal tract, Reaction of content of, F. C. Mann and J. L. Bollman (abstract), 619.
 Gastrojejunocolic fistule, H. W. Wiese, 477.
 Gatewood, —, 540, 972.
 Gaudin, Ch., 923.
 Gauss, C. J., 110.
 Gauss (cited by E. Zweifel), 585.
 Gauvain, Sir Henry, 1015.
 Gavazzeni, Antonio, 100.
 Gebhardt, George F., 352.
 Gebhardt, Hans, 617.
 Geddie, Kenneth B., 430.
 Geiger (cited by B. Rajewsky), 571.
 Gendreau, J. E., 378, 802.
 General Electric Laboratories, 708, 711.
 General Electric X-ray Corporation, 464, 744.
 Genital tract, tuberculosis of, Diagnosis and treatment of, J. D. Barney, J. L. Watson, and S. Elliott (abstract), 796.
 Genito-urinary tract, Anomalies of, A. C. Abbott (abstract), 105.
 [Genito-urinary tract] Bladder tumor pathology, Clinical application of, P. W. Aschner (abstract), 790.
 Genito-urinary tract, electrosurgery and diathermy in treatment of diseases of, Present status of, A. G. Fleischman (abstract), 797.
 [Genito-urinary tract] Renal pelvis, Unusual duplication of, H. C. Bumpus, Jr. (abstract), 790.
 [Genito-urinary tract] Renal vessels, New technic for roentgenographic study of, G. Milles, E. F. Müller, and W. F. Petersen (abstract), 1002.
 [Genito-urinary tract] Ureteral calculus, Giant, F. S. Patch (abstract), 790.
 Genner, Viggo, 578.
 Gentner, Wolfgang, 839.
 George, A. W., 33, 37, 907, 908, 917.
 German Roentgen Ray Society, 785.
 Gerngross, O., 595.
 Gershon-Cohen, J., 432, 972.
 Gerstenberger, Henry J., 740, 743.
 Gertz, Willy, 703.
 Geschickter, Charles F., 11-180, 182, 185, 210, 214, 215, 220, 223, 234, 236, 242, 283-290, 649, 667, 678, 679, 828.
 Geschickter, Charles F., Roentgenologic diagnosis of bone tumors, 111-180. *See other references.*
 Geyman, Milton J., 427, 483-485, 614, 798.
 Geyman, Milton J., Right diaphragmatic hernia, 483. *See other references.*
 Gezelius, Roy A., joint-author, 461.
 Gfrörer, O., 572, 611.
 Ghio, Adolfo, 92.
 Gibbon, John H., 652.
 Gibert, P., 960.
 Gibson, A., 210.
 Giesecke (cited by E. Zweifel), 585.
 Gifford, S. R., 743.
 Gilbert (cited), 1015.
 Gilbride, John J., 102.
 Gill, E. G., 611.
 Gilman, Robert L., 978.
 Gilmore, W. H., 1027.
 Ginsburg, Solomon, 210, 1028.
 Giuntoli, Lorenzo, 97.
 Glamann (cited by W. Abitz, O. Gerngross, and K. Herrmann), 595.
 Glands, mesenteric, Clinical picture of calcification of, H. Rothmann (abstract), 822.
 Glaser, Mark A., 922.
 Glasewald, H., 925.
 Glass-blower's cataract, 836.
 Glasser, Otto, 2, 4, 5, 7, 8, 11, 304, 311, 312, 316, 407, 698, 700, 702, 703, 798, 1016.
 Glénard, Franz, 624.
 Gliomas, Intracranial calcification with particular reference to that occurring in, C. B. Courville and L. J. Adelstein (abstract), 818.
 Glocker, R., 406.
 Gocke, C., 925.
 Goeckerman, W. H., 328, 329, 331, 333, 737, 743.
 Goiter, Size of heart in: Teleroentgenographic study, L. M. Hurxthal, O. J. Menard, and M. E. Bogan (abstract), 802.

- Goiter, toxic, Roentgen treatment of, E. Hayer and W. Hufschmid (abstract), 431.
- Goiter, toxic, Results of radiation therapy in, P. Jaguttis (abstract), 1028.
- Golden, R., 254, 263, 270.
- Goldhaft, Arthur D., 975.
- Goldhammer, Karl, 76, 966.
- Goldschmidt, W., 256, 270.
- Goldsmith, Perry G., 816.
- Goldstein, H. I., 679.
- Goldstein, H. Z., 679.
- Goldjanitki, J. A., 925.
- Goltz, E. V., 583.
- [Gonorrhea] Para-urethral infiltrates, Contribution to roentgen treatment of, S. Grauer (abstract), 418.
- Gonorrheal infection, chronic, in female, Deep X-ray treatment of, C. M. Henry, 47-50.
- Goodman, Herman, 818.
- Goodyear, Henry M., 1023.
- Gordon, Alfred, 925.
- Gorsch, Rudolph V., 925.
- Gosset, A., 707, 718.
- Götz, F. W. Paul, 835.
- Gouin (cited by A. Krynski), 811.
- Gow, J. T., 535.
- Graham, Roscoe R., 1029.
- Graham (cited by G. Milles, E. F. Müller, and W. F. Petersen), 1002.
- Granger, Amédée, 814.
- Granger, F. B., 729.
- Graninger, Karl, 941.
- Granzow-Irrgang, Dorothea, 704.
- Grauer, Sepp, 418.
- Gray, A. L., 84.
- Gray, Irving, 97.
- Gray, Thomas L., 964.
- Grebe (cited by B. Thom), 787.
- Greenebaum, J. Victor, 429.
- Greenhill, J. P., 336, 339.
- Greenough, Robert B., 244, 687, 693.
- Greensfelder, Louis A., 34, 37.
- Grenz rays, 304, 797, 798.
- Grenz rays, Absorption of, in air, H.-T. Meyer (abstract), 798.
- [Grenz rays] Bucky's "borderline rays" in ophthalmology, Application and dosage of, I. Krasso (abstract), 784.
- Grenz rays, Effect of, upon skin: Histological investigations, K. Herxheimer and E. Uhlmann (abstract), 797.
- Grenz-ray therapy, Necessity of exact dosage data in, O. Gfrörer and H. Berger (abstract), 611.
- (Grenz rays), Therapy with long wave length X-rays, Francis Carter Wood and George M. MacKee, 697.
- Grenz-ray tubes, Calibration of, O. Gfrörer (abstract), 572.
- Gricouloff, Georges, 109.
- Grier, G. W., 815, 888, 891.
- Grigsby, E. S., 942, 953.
- Grimault, L., 925.
- Groll, Edeltraud, 598.
- Gronwall, T. H., 868.
- Groover, T. A., 814, 841-844, 940.
- Groover, Thomas A., Radiology as career, 841. *See other references.*
- Gruhn, E., 410.
- Grunewald, Lucile, 729.
- Grünthal, J., 1017, 1020.
- Guerrini, F. Z., 925.
- Guillemin, A., 925.
- Günther, P., 779.
- Gurd, Fraser B., 585.
- Gurdjian, E. S., 819.
- Gutmann, A., 718.
- Gutmann, R. A., 928.
- Guttmann, Ludwig, 422.
- Gynecologic Department of Instituto del Cancro, Milan, Work of, during its first two years of activity, G. Moglia (abstract), 1009.
- Gynecological roentgen therapy, Development of, during past ten years in Second University Clinic for Women at Budapest, F. Gál (abstract), 400.
- [Gynecology] Gynecological notes, with special reference to use of radium, K. Wilson (abstract), 807.
- Gynecology, irradiation therapy in, Present value of, F. Heimann (abstract), 800.
- Gynecology, Radium in, S. Forsdike (abstract), 799.
- Gynecology, Roentgen therapy in, VIII (Principles of roentgenotherapy), E. A. Pohle (abstract), 418.
- Gynecology, roentgenographic contract diagnosis in obstetrics and, Newer methods of, J. Jarcho (abstract), 801.
- Habbe, J. E., 84, 95, 98, 99, 102, 364, 400, 401, 403, 409, 410, 414, 423, 424, 430, 433, 548-553, 572, 576, 585, 590, 601, 602, 604, 606, 617, 686, 696, 786, 788, 799, 808, 811-813, 816, 820, 831, 979, 992, 1006, 1028, 1031.
- Habbe, J. E., Malignant tumor of ethmoid, 548. *See other references.*
- Hadda, S., 244.
- Haenisch, Fedor, 77, 78, 961, 966-969.
- Hailey, Howard, 807.
- Haines, W. F., 75.
- Halban, Josef, 811.
- Halberstaedter, L., 457, 459.
- Hall, Robert C., 563.
- Hall, W. W., 706, 707, 718.
- Haller (cited by N. Voorhoeve and H. W. Wiese), 480.
- Hamant (cited by J. R. Moore), 242.
- Hambleton, A., joint-author, 869.
- Hammerschlag, Sigfrid, 418.
- Hampton, A. O., 904, 992.
- Hands and feet, Ringworm of, W. A. Osborne (abstract), 420.
- Hands, bones of, and feet, An X-ray and clinical study of, Max Kahn, 211.
- Hand, long bones of, Cysts of, and foot, H. Platt (abstract), 984.
- Hands, warts on, treatment of, 343-345.
- Handley, W. Sampson, 690, 693, 1015.
- Hanks (cited by J. C. Potter), 798.
- Hanrahan, Edward M., Jr., 404.
- Hanson, Malcolm B., 73.
- Harding, D. B., 995.
- Harker, G., 783.
- Harmer, Torr W., 244.
- Harris, A. Trevenning, 335, 338.
- Harris, G. W., 830.
- Harris (cited by L. L. Hill, Jr.), 789.
- Hart, Alan L., 368, 575, 579, 580, 618, 791.
- Hartley, J. N. J., 925.
- Hartman, George W., 795.
- Hartman, J. I., 743.
- Hartmann, E., 962.
- Hartmann, H., 377.
- Hartmann (cited by W. W. Belden), 925.
- Hartwell, John B., 925.
- Hartwell (cited by H. Baumecker), 619.
- Hase, Hermann, 904.
- Hasley, Clyde K., 73.
- Hattori (cited by M. Saito, K. Kamikawa, and H. Yamagizawa), 608.

- Haudek, Martin, 849, 855, 963, 964.
 Hay (cited by H. K. Pancoast), 600.
 Hayek, Heinrich, 925.
 Hayer, E., 431.
 Hayes, Richard, Double gall bladder, with double cystic duct: case report, 66.
 Hazen, H. H., 341, 345.
 Heacock, C. H., 96.
 Head clamps for fenestrated shield for roentgenography of nasal accessory sinuses, Mrs. J. D. Blocher, 554.
 Head injuries, acute, Treatment of, A. D. Young (abstract), 425.
 Head, Jerome R., 95, 499, 507.
 Headaches, Menstrual, C. L. Martin (abstract), 798.
 Headaches, menstrual, Radiation therapy in, C. L. Martin (abstract), 415.
 Healy (cited), 585.
 Hearst, William L., 582.
 [Heart] Cardiovascular border, Study of right, P. Perona and G. Ottaviani (abstract), 1010.
 Heart, Effect of amyl nitrite on size of, and width of aortic shadow as determined roentgenologically, W. A. Brams and H. A. Strauss (abstract), 802.
 Heart, effects of gamma rays and short X-rays upon human, Far-reaching: Electrocardiographic results of cancer treatments given without direct irradiation of heart, J. E. Gendreau (abstract), 802.
 [Heart] Electrocardiographic changes in pneumonia, A. M. Master and A. Romanoff (abstract), 1010.
 Heart, human, Excitatory process observed in exposed, P. S. Barker, A. G. Macleod, and J. Alexander (abstract), 403.
 [Heart] Hydropneumopericardium: Report of case with summary of literature, R. T. Shackelford (abstract), 1011.
 Heart muscle, Experimental roentgen injuries of, A. Werthermann (abstract), 994.
 Heart, Radiologic aspect of lungs and valvular defects of, G. Balestra and A. Ghio (abstract), 92.
 Heart, size of, Comparison of methods used for estimating, S. Luton (abstract), 403.
 Heart, Size of, in goiter: Teleroentgenographic study, L. M. Hurxthal, O. J. Menard, and M. E. Bogan (abstract), 802.
 Heart, Syphilis of aorta and: Clinical study, S. S. Riven and J. Reigenbaum (abstract), 1010.
 [Heart] Thrombosis of left auricular appendage, Roentgenologic appearance of, J. Arendt (abstract), 403.
 Heatley, John E., 401.
 Heeren, I., 418.
 Hefke, H. W., 78, 83, 85, 95, 100, 101, 107, 404, 406, 414, 415, 417, 418, 422, 423, 428, 429, 433, 573, 575, 576, 578, 579, 581, 599, 600, 602, 604, 610, 617, 619-623, 787, 788, 793, 801, 804, 807, 812, 821-823, 825, 826, 828, 830, 834, 839, 932, 964, 975, 986, 990, 992, 993, 996, 997, 999, 1003, 1006, 1007, 1009, 1011, 1017, 1020, 1022, 1026.
 Heidenhain (cited by J. Halban), 811.
 Heilbron, L. G., 357.
 Heim, K., 1009.
 Heimann, Fritz, 800.
 Heineke (cited), 412, 565.
 Hektoen, Ludvig, 75.
 Held, A., 411.
 Heliotherapy in pulmonary tuberculosis, Limitations of, B. L. Wyatt (abstract), 826.
 Hellström, Nils, 270.
 Helm (cited by Felix Fleischner), 20, 28.
 Hematuria, essential, X-ray treatment of (case report), L. J. Carter, 944.
 Hemingway, Allan, 736.
 Hemorrhage in perforated gastric and duodenal ulcers, Incidence of, M. Behrend (abstract), 621.
 Henderson, E. F., 270, 855.
 Henderson, M. S., 133, 179.
 Henderson, Yandell, 507.
 Hendricks, Sterling B., 597.
 Hendricks, William A., 925.
 Hengstenberg, J., 779.
 Henning, A. E., 8.
 Henry, C. M., Deep X-ray treatment of chronic gonorrheal infection in female, 47-51.
 Henry, Lucas S., 563.
 Henry, Myron O., 427, 925.
 Herbst, Robert H., 1004, 1008.
 Heredosophilis, tardive, Bone lesions in, E. P. Pendergrass, R. L. Gilman, and K. B. Castleton (abstract), 978.
 Herendeen, Ralph E., 179, 284, 287, 638, 643, 647.
 Herman, Karl, 599.
 Hernaman-Johnson, F., 810, 1017.
 Hernia, diaphragmatic, Right, M. J. Geyman, 483.
 Hernia, diaphragmatic, roentgenologic diagnosis of, Progress in, A. B. Moore and B. R. Kirklin (abstract), 609.
 Hernia, diaphragmatic, Very large, P. Eichler (abstract), 610.
 Herr, A., 58.
 Herrmann, Karl, 595, 597.
 Herrnheiser, Gustav, 853, 855.
 Herxheimer, Karl, 797.
 Herz, Franz, 620.
 Hess, George H., 214.
 Hesz, P., 1029.
 Hettich, William G., 964.
 Heurtaux (cited by T. S. Raiford), 270.
 v. Hevesy, G., 779.
 Heyman, James, 416.
 Heyman (cited by K. Wilson), 807.
 Hibben, J. S., 729, 737.
 Hibbs, Russell A., 918, 925.
 Hickey Cone, 71.
 Hickey, Preston M., 50, 71-73, 384, 392, 1010.
 Hickey, Preston M., Memorial Library, 384.
 Hicks, Robert A., 710, 719.
 Higgins, C. C., 431.
 Higgins, G. M., 507.
 Highman, Walter James, 702.
 Hill, E., 706, 718.
 Hill, Frederick C., 480, 482.
 Hill, Sir Leonard, 1013.
 Hill, Luther L., Jr., 789.
 Hill (cited by G. Milles, E. F. Müller, and W. F. Petersen), 1002.
 Hiller, Robert I., 34, 37.
 Hintze, A., 457, 459.
 Hip joint, epiphysitis of, Acute transient, O. L. Miller (abstract), 981.
 Hirsch, E. F., 209, 210.
 Hirsch, Henri, 415.
 Hirsch, I. Seth, 357, 936, 940.
 Hirschsprung (cited by R. R. MacGregor), 999.
 Hirsh, A. B., 729.
 Hitchcock (cited by W. Devrient, S. Thyssen, and B. Sokoloff), 749.
 Hitzenberger, Karl, 828.
 Hoag, J. B., 535.
 Hoard, J. L., 595.
 Hocking (cited by G. T. Pack and F. W. Stewart), 591.
 Hodges, Fred Jenner, 403.
 Hodges, Fred M., 758, 759.
 Hodges, Paul C., 577, 820, 821, 1026.

- Hodgkin's disease, 416, 803, 804, 1011, 1012.
- Hodgkin's disease and tuberculosis, Analysis of lymphadenopathy question, with special reference to, F. W. Stewart and C. A. Doan (abstract), 803.
- Hodgkin's disease, autogenous gland filtrate in, Results of treatment by, E. M. Hanrahan, Jr. (abstract), 404.
- Hodgkin's disease, Bone changes in, K. Kremser (abstract), 804.
- Hodgkin's disease, Genetic neoplastic relationships of, aleukemic and leukemic lymphoblastoma, and mycosis fungoides, A. S. Warthin (abstract), 803.
- [Hodgkin's disease] Lymphogranulomatosis of vertebral column, W. Kuckuck (abstract), 1011.
- [Hodgkin's disease] Lymphoma malignum and lymphosarcoma: Pathogenesis, radiotherapy, and prognosis, I. Levin (abstract), 1012.
- Hodgkin's disease, morphogenesis of cells of Sternberg in, Study of, L. Villa (abstract), 1011.
- Hodgkin's disease, with special reference to diagnostic difficulties and results following roentgen irradiation: Report of case, G. A. Sherman (abstract), 1012.
- Hoede, Karl, 611.
- Hoeffel, Gerald, 743.
- Hoffheinz (cited by D. P. Barr and H. A. Bulger), 431.
- Hoffmann, F., 600.
- Hoffmann, Wolfgang, 836, 1019.
- Hofmann, Ulrich, 598.
- Hofmann, —, 581.
- Holfelder, Hans, 428, 589, 1021.
- Holfelder's Clinic, 418.
- Holladay, W. L., Constant temperature for X-ray developing, 346.
- Holland, C. Thurstan, 925.
- Hollander, Lester, 891.
- Holliger, Charles D., Sheldon, Francis B., Report of long retained foreign body of unusual size, 952.
- Holly, Leland E., 401.
- Holly (cited by H. B. Matthews), 799.
- Holtzhusen, H., 3, 312.
- Holtzknecht, Guido, 98, 964.
- Holweck, Fernand, 703.
- Horder, Sir Thomas, 602, 603, 969.
- Horn, Frank J., 50.
- Horsley, J. Shelton, Case of recurrent giant-cell tumor of lower right radius, 756.
- Horsters, Hans, 1007.
- Hosmer, Helen R., 708, 718, 736.
- Hospitals—
- Barnes, St. Louis, 477.
- Brigham (Peter Bent), Boston, 787.
- Buffalo City, 601.
- Charity, New Orleans, 402.
- City, Vienna, 1011.
- Civile di Teramo, Ospedale, Italy, 941.
- General, Los Angeles, 346.
- General, Rochester, N. Y., 953.
- Harrisburgh (Pa.), 694.
- Huntington, Collis P., Mem., 831, 890.
- Jewish, Cincinnati, O., 429.
- Jewish, New York, 637.
- Johns Hopkins, Baltimore, 211, 216, 231, 232, 235, 241, 253, 269, 279, 281, 391, 649, 653, 660.
- Kelly, Howard A., Baltimore, 391.
- Massachusetts General, 831, 890.
- Memorial, New York, 50, 373, 548, 592, 628, 635-637, 639, 640, 647-649, 651, 653, 654, 883, 888.
- Montreal General, 103, 107, 790, 830.
- Moses Taylor, Scranton, Pa., 766.
- Municipal, Baltimore, 391.
- Neurological, New York, 608.
- New York Broad Street, 636.
- Park View, 90.
- Presbyterian, Chicago, 972.
- Presbyterian, New York, 425.
- Royal Victoria, Montreal, 425, 829.
- Ruptured and Crippled Children, New York, 631, 636-638, 649, 650, 653, 655.
- St. Agnes, Baltimore, 391.
- St. Bartholomew, London, England, 586, 969.
- St. Luke's, New York, 691, 692.
- St. Michael's, Toronto, 1003.
- Sheppard and Enoch Pratt, Baltimore, 391.
- State, for Malignant Disease, Buffalo, N. Y., 373.
- Union Memorial, 264, 267.
- U. S. Marine, Stapleton, Staten Island, N. Y., 644.
- University, Ann Arbor, 1010.
- University, Minneapolis, Minn., 73.
- University, Syracuse, N. Y., 59, 64.
- Victoria Memorial, Victoria, B. C., 51.
- Westminster, London, England, 586.
- Winnipeg General, Winnipeg, Canada, 87.
- Wisconsin General, 945.
- Hotz (cited by L. Schall and F. Hoffmann), 600.
- Hough, W. H., 391.
- Houston, Thomas, 210.
- Howard, C. P., 830.
- Howard, Philip J., 1028.
- Howard, William T., Jr., 637, 643.
- Howell, J. C., 690, 693.
- Howes, Seth F. H., 423.
- Hoy, Carl Da Costa, 925.
- Hrdlicka, Ales, 391.
- Hrytschak (cited by W. F. Braasch), 108.
- Hubeny, M. J., 339, 720-724, 959.
- Hubeny, M. J., Oblique projection in examination of lumbar spine, 720. *See other references.*
- Huchard (cited by R. T. Shackelford), 1011.
- Hudson, Jessie B., 423.
- Hudson, J. C., 13, 868.
- Hufschmid, W., 431.
- Hughes, C. W., 736.
- Hull, Harry B., 352.
- Hume-Rothery, William, 781.
- Humerus, upper, Lesions of, Robert C. Major, 224.
- Hummel, Rudolf, 806.
- Hunt, Barbara, 987.
- Hunt, Edward L., 997.
- Hunt, John G., 817.
- Hunt, Verne C., 797.
- Hurwitz, S. H., 180.
- Hurxthal, Lewis M., 802.
- Hutter, Karl, 106.
- Hydrops tubæ profluens, Diagnosis and therapy of case of, by palpography, O. Polano (abstract), 400.
- Hyman, Abraham, 78, 105.
- Hypernephroma, 160, 203.
- Hyperparathyroidism, J. de J. Pemberton and K. B. Geddie (abstract), 430.
- Hyperparathyroidism, Clinical syndrome of, D. P. Barr and H. A. Bulger (abstract), 431.
- Hyperthermia, Experimental, induced by high frequency current, Bernard Mortimer, 705.
- Hyperthyroidism (Basedow), 399.
- Hyperthyroidism, Possible significance of thymus gland in syndrome of, H. M. Margolis (abstract), 1026.
- Hyperthyroidism, Roentgen treatment of, W. Clarkson (abstract), 813.
- Hypoventilation, pulmonary. Post-operative, R. H. Overholt (abstract), 605.

- Ileocolic mesenterium commune without rotation, Case of, G. Sighinolfi (abstract), 103.
- Imbert, Leon, 925.
- Imboden, H. M., 393.
- Indiana Roentgen Society, 772.
- Infection, urinary, Birth traumatism as factor in, F. S. Patch (abstract), 107.
- Influenza patients during epidemic in 1928-29, Roentgenologic studies of pulmonary pictures in, B. Misske and A. Sylla (abstract), 607.
- Infra-red, Effect of visible light, and ultra-violet rays on eye, W. Hoffmann (abstract), 836.
- Injections, intravenous, for cancer, 439.
- Insurance Committee, report of, 562.
- International Congress of Radiology, London, 1925, 592.
- International Congress of Radiology, Second, 1.
- International Congress of Radiology, Third, 74, 389, 960-962.
- Internship, Roentgenology and, Irvin D. Metzger, 68-70.
- [Intestines] Bowel disease, terminal, Sigmoidoscopy versus X-rays in diagnosis of, F. C. Yeomans (abstract), 622.
- [Intestines] Bowel, large, Origin of polypi of, with especial reference to adenoma: preliminary report, W. A. Fansler (abstract), 624.
- [Intestines] Bowel, small, and stomach, Appraisal of motor-test-meal in roentgen examination of, A. B. Moore (abstract), 97.
- [Intestines] Cecum, diverticulitis of, Solitary, A. Stewart (abstract), 996.
- [Intestines] Cecum, Misplacements of, and ascending colon, G. Bagnaresi (abstract), 998.
- [Intestines] Colon, Diverticulitis of, with special reference to acute perforations of sigmoid, R. W. Whitman (abstract), 997.
- [Intestines] Colon, malignant, conditions of, Diagnosis of, F. W. Rankin (abstract), 998.
- [Intestines] Colon, Roentgenologic examination of, H. H. Berg (abstract), 999.
- [Intestines] Intestinal obstruction, Acute, I. Abell (abstract), 620.
- [Intestines] Intestinal obstruction, Acute, F. Smithies (abstract), 621.
- [Intestines] Intestinal stasis, Value of X-ray evidence of bowel obstruction in various states of, H. A. Carlson, H. J. Dvorak, F. W. Lynch, C. Borman, and O. H. Wangenstein (abstract), 995.
- [Intestines] Intussusception, Acute, in infancy: operative and non-operative treatment, D. M. Siperstein (abstract), 1000.
- Intestines, small, chronic obstruction of, Contribution to roentgenologic diagnosis of, G. Lemmel (abstract), 623.
- Intestine, small, Roentgen evidence of adhesions of, H. W. Soper and J. W. Thompson (abstract), 102.
- Intestine, Tuberculosis of: Its differential diagnosis, J. A. Bagen (abstract), 824.
- Intestine, Tumors of the small: their diagnosis, with special reference to the X-ray appearance, Theodore S. Raiford, 253.
- Intestines, upper small, Contribution to diagnosis of obstruction in, C. Wittkowsky and Metzger (abstract), 621.
- Intracranial calcification and its roentgenologic significance, J. D. Camp (abstract), 422.
- Intracranial pressure: correlation of choked disc and roentgenologic pressure signs, F. Schreiber (abstract), 424.
- Intussusception, acute, X-ray examination in, E. Edberg (abstract), 617.
- Intussusception: case report, C. E. Weaver, 64-66.
- Iontoquantimeter, Rugged, direct-reading, of high sensitivity, L. P. Delsasso and A. H. Warner, 39-43.
- Ireland, Merritte W., 391.
- Iron, Separation of carbon from carbon monoxide in (III.—Formation of iron oxides and iron carbides in solid phase), U. Hofmann and E. Groll (abstract), 598.
- Irradiated tissues, Healing of operated wounds in, V. Podestà (abstract), 839.
- Irradiation of body cavities by ultra-violet light generated in them, S. Westmann (abstract), 839.
- Irradiation of school children, Sir L. Hill and A. R. Laurie (abstract), 1013.
- Irradiation on inflammations, Studies on prophylactic effect of, S. Fukase (abstract), 840.
- Irradiation, Quartz lamp, with reflector, A. Keuser (abstract), 1013.
- Irradiation, Reaction to, as means of differentiating certain varieties of tumor, A. U. Desjardins (abstract), 831.
- Irradiation, sarcoma of uterus treated by, Few cases of, C. Regaud and A. Lacassagne (abstract), 832.
- Irradiation therapy in gynecology, Present value of, F. Heimann (abstract), 800.
- Irradiation therapy of malignant tumors in Sweden, G. Forssell (abstract), 833.
- Italian Congress of Medical Radiologists, Ninth, Proceedings of, 394, 395.
- Italian Congress of Obstetrics and Gynecology, 1009.
- Ivy, A. C., joint-author, 52; 623, 718, 805.
- Jaches, Leopold, 394, 791.
- Jackson, Byron H., 766-769, 931.
- Jackson, Byron H., Report of two cases of osteogenic sarcoma, possibly traumatic in origin, 766. See other reference.
- Jackson, Chevalier, 93.
- Jackson, C. R., 74.
- Jackson, Henry, Jr., 692, 693.
- Jackson (cited by E. P. Pendergrass), 821.
- Jacob, P., 28.
- Jacobi, H., 861.
- Jacobi, Hans, 925.
- Jacobson, L. E., 304.
- Jacoby, Paul, 427.
- Jadassohn, J., 340, 345.
- Jaeger, Robert, 3, 9, 10, 12, 611.
- Jagoda, S., 412.
- Jaguttis, P., 1028.
- James, R. W., 76.
- Jamieson, Howard M., 584.
- Jamieson, R. Hillhouse, 810.
- Janitzky, A., 77.
- Jansson, Gösta, 578.
- Japiot, P., 926.
- Jaques, L., 922.
- Jarcho, Julius, 801.
- Jaroschy, Wilhelm, 92.
- Jarre, Hans A., 58, 84, 88, 93-95, 97, 102, 107, 399, 406, 573, 607, 609, 832.
- v. Jaschke (cited by E. Zweifel) 585.
- Jaundice, Clinical significance of, M. A. Blankenhorn (abstract), 804.
- Jaundice, obstructive, Physiologic disturbances incident to, A. C. Ivy (abstract), 805.
- Jaw, lower, Central tumors of, Richard F. C. Kegel, 216.
- Jaw, upper, Giant-celled tumor of, H. W. Coates (abstract), 827.
- Jean, G., 926.
- Jeannel (cited by John R. Moore), 234, 242.

- Jeffries, F. M., 635, 637, 638, 647.
 Jenkinson, E. L., 485, 772.
 Jennings, C. H., 335, 338.
 Jennings, John E., 688, 693.
 Jensen, Murk, 179.
 Johnson, Eugene F., 825.
 Johnson, L. D., 618.
 Johnson, J. Martin, 609.
 Johnson, W. T., 729.
 Johnston, J. A., 1028.
 Johnston, James C., 426.
 Joints, chondromatosis of, Contribution to, Hofmann (abstract), 581.
 "Joint mice," 578, 579.
 Joisten, Chr., 926.
 Joll, C. A., 180.
 Jones, Jack W., 417, 979.
 Jordan, Sara M., 480, 482.
 Jorge (cited by W. W. Belden), 926.
Journal of the American Medical Association, 972.
 Judd, E. Starr, 785.
 Jude (cited by W. W. Belden), 926.
 Judet, Henri, 926.
 Jugenburg, Anna, 432.
 Jüngling, Otto, 329, 333, 610.
 Juul, Jens, 784.
 Kaboth, Georg, 408.
 Kahler, H., 710, 718.
 Kahlstorf, A., 580, 812, 1017.
 Kahn, Herbert, 829.
 Kahn, Max, 202, 211-215, 216, 221, 960.
 Kahn, Max, X-ray and clinical study of bones of hands and feet, 211. *See other references.*
 Kahn (cited by H. Hirsch), 415.
 Kailan (cited by G. Harker), 784.
 Kamikawa, Kazunori, 608.
 Kann, Ulysses S., 563.
 Kantner, —, 58.
 Kantor, John L., 101.
 Kaposi (cited by R. H. Stevens), 444.
 Karshner, Rolla G., 433.
 Kaplan, Ira I., 773, 936, 940.
 Katz (cited by W. Abitz, O. Gerngross, and K. Herrmann), 595.
 Kaufmann (cited by A. Brunschwig), 995.
 Kauftheil, Leo, 480, 482.
 Kaye, G. W. C., 4, 5, 7, 8.
 Kearns, P. J., 829.
 Keen, W. W., 64.
 Kegel, Richard F. C., Central tumors of lower jaw, 216.
 Kehrer, E., 426.
 Keiller, V. H., 179.
 Keller, Henry, 608.
 Keller, William L., 598.
 Kellogg, E. L., 944.
 Kelly, Howard A., 210, 534.
 Kennedy, Robert H., 926.
 v. Kémeri, Dezső, 491.
 Kern, Richard A., 507.
 Keuser, A., 1013.
 Key, J. Albert, 168, 180, 982.
 Key-Aberg, Kurt, 270.
 Keynes, Geoffrey, 586, 1015.
 Kidneys, Demonstration of, with abrodil and some remarks about roentgen stereoscopy of kidney, W. Teschendorf (abstract), 792.
 Kidneys, exposed, Roentgenological control of, in operations for nephrolithiasis, with use of special intensifying cassette, E. Beer (abstract), 1007.
 Kidneys, intravenous pyelography in pathological conditions of, Experimental research concerning, G. Gabriel (abstract), 791.
 Kidney pelvis, Changes in, on roentgen film caused by extra-renal tumors, R. Bachrach and K. Hitzzenberger (abstract), 828.
 Kidney, tuberculosis of, Roentgenologic diagnosis in, B. H. Nichols (abstract), 794.
 Kiel, University of, medical clinic, 431.
 Kienböck, Robert, 83, 577, 978, 1021.
 Kienböck's disease: compression osteitis of semilunar or lunette bone of wrist: report of cases, N. A. Cary and L. Barnard (abstract), 978.
 Kienböck's disease of semilunar bone, N. Porro (abstract), 577.
 Kilgore, A. R., 378, 679-682.
 Kilgore, Alson R. and Garland, L. H., Osteitis fibrosa localisata, 679.
 Kilian (cited by W. W. Belden), 916.
 Kime, E. N., 729.
 King, E. L., 270.
 Kingery, L. B., 340, 345, 443, 589, 967.
 Kinney (cited by C. G. Dyke), 424.
 Kirklin, B. R., 73, 328-333, 609, 786, 972, 973.
 Kirklin, B. R., and Morton, S. Archibald, Roentgenologic changes in sarcoid and related lesions, 328.
 Kirsch, Hans, 703.
 Kirschmann, K., 968.
 Kisch, Eugen, 827.
 Kiser, Edgar F., 604.
 Klason, T., 614.
 Klauder, Joseph V., 743.
 Klein, O., 473.
 Kleinberg, S., 926.
 Kleinhaus, Emil, 926.
 Klemm, Paul, 187, 188.
 Klemmer, R. N., 819.
 Klippel-Feil disease, A. J. Pytel and S. S. Chaievitch (abstract), 427.
 Kloiber, Hans, 926.
 Klotz, Hermann G., 933, 935.
 Klöveborn, G. H., 704.
 Knaggs, Robert Lawford, 165, 167, 179, 180.
 [Knee] Femoral epiphysis, lower, Slipping of, J. J. Kurlander (abstract), 981.
 Knee joint, Tuberculosis of, demonstrated by oxygen injection into joint, B. Ulrichs (abstract), 433.
 Knol, K. S., 780.
 Knospe, Heinz, 418.
 Knothe, Werner, 572.
 Kobak, Disraeli, 729.
 Koch, Konrad, 926.
 von Koch, Ph., 480, 482.
 Kodoloid (Eastman), 325.
 Koebig, Walter C. S., 925.
 Kohbrausch, K. W. F., 468, 512, 518.
 Köhler, Alban, 37, 978.
 Kohn, S. E., 430.
 Kolb, Otto, 926.
 Kolodny, Anatole, 179, 641, 666, 669, 671, 678.
 König (cited by G. Jansson), 578.
 Konjetzny (cited by M. Haudek and J. D. Camp), 851, 855.
 Konzleemann, F. W., 328, 330, 332.
 Kornblum, Karl, 364.
 Kosting, Peter R., 597.
 Kourilsky, R., 29.
 Kovarik, A. F., 534.
 Kracek, F. C., 594.
 Krasso, Ilona, 784.
 Krause, Paul, 52, 57.
 Krebs, Carl, 564, 565.
 Kreibich, Karl, 329, 333.
 Kremser, Curt (or Kurt), 804, 814.

- Kretschmer, Herman L., 106, 538, 542.
 Kreuz, cited by E. Freund, 84.
 Krishnamurti, P., 594.
 Kroenig (cited by E. Zweifel), 585.
 Kruchen (cited by G. A. Sherman), 1013.
 Krummacher (cited by W. Abitz, O. Gerngross, and K. Herrmann), 595.
 Krusen, Frank Hammond, 729.
 Krynski, A., 811.
 Ksanda, C. J., 594.
 Kuckuck, Walter, 1011.
 Kuhn (cited by F. C. Wood and G. M. MacKee), 704.
 Kulenkampff, H., 304.
 Kurlander, Joseph J., 981.
 Kurtz, A. D., 237, 244.
 Küstner, Hans, 3, 304, 703, 904.
 Küttner, Hermann, 144, 179, 480, 482.
 Kutzmann, Adolph A., 791.
 Kuznitsky, E., 330, 333.
 Laborde (cited by A. Steindler), 983.
 Laby, T. H., 597.
 Lacassagne, A., 88, 703, 807, 832, 891, 985, 1020.
 Lacharité, H., 84.
 Lachmann, Ernst, 603.
 von Lackum, H. L., 929.
 Lacouture (cited by W. W. Belden), 926.
 Laennec, Théophile, 25.
 Lahey, Frank H., 480, 482.
 Lake, George B., 729.
 Lakhowsky, G., 718.
 Lambie (cited by W. W. Webster), 916.
 Lambranzi, Mario, 1018.
 Lambret (cited by H. W. Weise), 480, 482.
 LaMotte, W. O., 75.
 Lanari, Eduardo L., 929.
 Lance (cited by W. W. Belden), 926.
 Landauer, L. S., 879.
 Landry, Benedict B., 270.
 Lane, Sir Arbuthnot, 916.
 Lane-Clayton, Janet, 987.
 Langendorff, H., 610.
 Lankenau Hospital Medical Clinic, 625.
 Lanzenberg (cited by W. W. Belden), 926.
 La Pierre, Gaston, 1016.
 Laqueur, A., 1013.
 Larimore, Joseph W., 974.
 Larkin (cited by S. Forsdike), 800.
 Laroche, Albert, 108.
 Larson, E. Eric, Report of patient with Ewing's sarcoma, 556.
 Larson (cited by A. L. Soresi), 491.
 Laryngology, Roentgen therapy in, 419.
 Larynx, Radium therapy in cancer of nose, and esophagus, H. M. Moran (abstract), 808.
 Lau (cited by H. Naujoks and H. I. Teperson), 334, 338.
 Laurie, Alan R., 1013.
 Lavedan, Jacques, 573.
 Law (cited by A. Granger), 814.
 Lawrence, Herman, 704.
 Lazarus-Barlow (cited by S. Forsdike), 800.
 League of Nations, Cancer sub-committee of Section of Hygiene, 85.
 Leavenworth, R. O., 815.
 Le Cocq, John F., 977.
 Leddy, E. T., 95, 101, 104, 408, 411, 414, 416, 423, 564, 572, 577, 599, 811, 817, 819, 822, 839, 941, 966-969, 973, 977, 998, 1010, 1018, 1026.
 Ledoux (cited), 96, 809.
 Ledoux-Lebard, —, 960.
 Lee, Burton J., 91, 297, 687, 693.
 Lee (cited by Hernaman-Johnson), 1017.
 Leeser, F., 975.
 Legal suggestions, S. W. Donaldson (editorial), 957.
 Lehotsky-Semmelweis (cited by E. Zweifel), 585.
 Lemmel, G., 623.
 Lemon, W. S., 507.
 Lemon (cited by W. W. Priddle), 601.
 Lenz, Maurice, 691, 693, 891.
 Léo, G., 926.
 Leonard, Ralph D., 33, 37, 907, 908.
 Léri, Andre, 926.
 Lerner, Charles, 704.
 Lester, H. H., 535.
 Leucutia, T., 812.
 Leukemia, myelogenous, palliative radiotherapy of, 299.
 Leukemia, myelogenous, Radiation treatment in, S. Hammerschlag and H. Knospe (abstract), 418.
 Levin, Isaac, 210, 1012.
 Levitin, Joseph, 831.
 Levitt, Walter M., 85, 86, 88, 89, 109, 535, 574, 969, 985.
 LeWald, L. T., 30, 37, 84, 484, 485, 788, 926, 930.
 Lewin, P., 237, 244.
 Lewis, Dean, 145, 146, 220, 223, 265, 642.
 Lewis, Silas A., 787.
 Lewisohn (cited by H. W. Wiese), 480.
 Levy, D. M., 704.
 Lévy, G. R. J., 926.
 Levyn, Lester, 37.
 Libman Foundation, 108.
 von Lichtenberg, Alexander, 108, 796, 972, 1001.
 v. Lichtwitz, —, 108, 972.
 Lichty, John A., 1000.
 Liechti, A., 861.
 Lieck (cited by G. Jansson), 578.
 Lick, E., 926.
 "Lienography," Clinical use of, new method for roentgenologic demonstration of spleen and liver, M. Oka (abstract), 95.
 Light intensities, very small, New measuring device for, B. Rajewsky (abstract), 571.
 Light, Screening effect of upper layer of epidermis to, L. Freund (abstract), 1013.
 Light therapy and general practitioner, A. Laqueur (abstract), 1013.
 Lindemann (cited by F. C. Wood and G. M. MacKee), 697.
 Lindh, Axel E., 779, 782.
 Lindner, Henry J., 583.
 Lindsay, H. C., 90.
 Lindsay, Janvier, W., 179.
 Lingeman, L. R., Congenital syphilis of bone: case report, 953.
 Lion, G., 481, 482.
 Lip, tongue, and skin, Cancer of: Ministry of Health report, J. Lane-Clayton (abstract), 987.
 Lips and mouth, malignant condition of, Early diagnosis and treatment of, F. A. Figi (abstract), 985.
 Lips, cancer of, mouth and, Radiation therapy in treatment of, J. M. Martin, 881.
 Lisa, James R., 997.
 Little, Clarence C., 986.
 Liu, J. Heng, 255, 270.
 Liver and spleen, new method for roentgenologic demonstration of, Clinical use of "lienography," M. Oka (abstract), 95.
 Liver, Anomalous enlargement of, and dissecting hematoma of phrenic nerve: case report, K. Kornblum and G. W. Stephenson (abstract), 364.
 Lobstein (cited by L. Prussak and N. Mesz), 579.
 Loewenstein, Ludwig, 807.
 Loewy, Georges, 480, 482.

- Lohmann, Anne, joint-author, 322.
 L'ombre, 608.
 Long, M. L., 706, 718.
 Long, Wendell, 987.
 Longcope (cited by S. S. Riven and J. Reigenbaum), 1010.
 Loomis, A. L., 709, 710, 717, 718.
 Looser (cited by A. R. Kilgore and L. H. Garland), 682.
 Lorenz, E., 4-7, 12.
 Loucks, R. E., 1021.
 Louraschi (cited by O. M. Walters, B. J. Anson, and A. C. Ivy), 52, 57.
 Loveland, E. R., 391.
 Lowsley, Oswald S., 1008.
 Luc (cited by J. G. Hunt), 817.
 Lucas, Ernst, 87.
 Lüdin, M., 990.
 Ludwig (cited by E. Conte), 837.
 Lumbar spine, Oblique projection in examination of, M. J. Hubeny, 720.
 Lundwahl (cited by E. Zweifel), 585.
 Lung abscesses: clinical study, with especial emphasis on conservative treatment, H. I. Spector (abstract), 606.
 Lung abscess, Differential diagnosis of pulmonary tuberculosis, and bronchiectasis, F. P. McNamara (abstract), 823.
 Lungs and bronchi, carcinoma of, Primary, E. V. Goltz (abstract), 583.
 Lungs and valvular defects of heart, Radiologic aspect of, G. Balestra and A. Ghio (abstract), 92.
 Lung, Asbestosis bodies in sputum and, K. M. Lynch and W. A. Smith (abstract), 94.
 Lungs following roentgen exposure, Changes in, M. Lüdin and A. Werthemann (abstract), 990.
 Lungs, Hairline in roentgenogram of, L. Schall and F. Hoffmann (abstract), 600.
 [Lung] Interlobar fissure in roentgenogram, Normal and pathologic, I. G. Brdiczka and G. Wolf (abstract), 602.
 Lung lesions, non-tuberculous suppurative, Diagnosis and treatment of, J. H. Stygal (abstract), 603.
 [Lungs] Lobus venæ azygos: visibility on roentgenologic examination and significance for clinician, G. Velde (abstract), 93.
 [Lungs] Mediastinal pleural effusion: roentgenologic study, J. Sagel and L. G. Rigler (abstract), 604.
 Lung, neoplastic and other diseases of, Mechanism of physical signs in, with especial reference to atelectasis and emphysema, C. Jackson (abstract), 93.
 Lungs, "Pleural rings" or annular shadows in, W. Mitchell (abstract), 602.
 [Lungs] Pneumonitis, non-tuberculous suppurative, abscess, and bronchiectasis, Treatment of, J. Alexander and W. W. Buckingham (abstract), 991.
 [Lungs] Pneumothorax, Spontaneous, J. P. Palmer and R. B. Taft (abstract), 990.
 Lung, primary carcinoma of, Notes on pathology of, W. Boyd (abstract), 87.
 [Lungs] Pulmonary disease, Dust and, A. E. Russell (abstract), 605.
 [Lungs] Pulmonary infection, Relation of sinus disease of, from standpoint of roentgenologist, W. F. Manges (abstract), 1022.
 [Lungs] Pulmonary sclerosis and pleural adhesions, Deformation and displacements of hilum in, G. Pescatori (abstract), 598.
 Lung roentgenogram, Limits between normal and pathologic in, Nonnenbruch (abstract), 989.
 [Lungs] Roentgenologic appearance of lobular pneumonia (bronchopneumonia), N. W. Potte (abstract), 94.
 [Lungs] Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, Eugene Freedman, 14-29.
 [Lungs] Silicosis, T. H. Belt (abstract), 604.
 Lungs, Syphilis of, K. Herman (abstract), 599.
 Lupi, A., 926.
 Lupo, Massimo, 926.
 Lussana, S., 926.
 Lustig, W., 968.
 Luton, Sinclair, 403.
 Lutz, Wilhelm, 331, 333.
 Lyddane, E. Stuart, 829.
 Lymphangitis, carcinomatous pulmonary, Contribution to diagnosis of, E. Lucas and H. Pollack (abstract), 87.
 Lymphoblastoma, aleukemic and leukemic, Genetic neoplastic relationships of Hodgkin's disease, and mycosis fungoides, A. S. Warthin (abstract), 803.
 Lymphogranuloma, benign (sarcoid), 328.
 Lymphogranulomatosis clinically cured for four years, Case of, M. ten Doornkaat-Koolman (abstract), 404.
 Lymphogranulomatosis, Roentgen treatment of, H. U. Billich (abstract), 416.
 Lymphoid tissue, Tumor involving, D. S. Childs, 59-64.
 Lynch, F. W., 995.
 Lynch, Kenneth M., 94.
 Lynham, —, 961.
 Lyon, Ernst, 926.
 Lyons, Clinton G., 997.
 Lyons, Dorothy, 743.
 McCafferty, Lawrence K., 179.
 MacCallum (cited by T. S. Raiford), 255.
 MacCarty, William C., 460, 660, 663, 851, 855.
 McClelland, J. C., 1006.
 McCord, Carey P., 52, 58.
 McCoy, George W., 391.
 MacCraken, W. H., 729.
 McCullagh, E. P., 589.
 MacDermot, H. E., 402.
 McElfratrick, George C., 75.
 MacFee, William F., Treatment of advanced cancer of breast, 687.
 McGlinn (cited), 585.
 McGraw (cited by C. D. Murray), 616.
 MacGregor, A. E., joint-author, 30-38.
 MacGregor, R. R., 999.
 McGuire, Stuart, 643, 651.
 MacKee, George M., 79, 90 (here incorrectly spelled "McKee"), 341, 345, 415, 419; joint-author, 697; 704, 739, 743, 817, 818.
 McKie, E. V. M., 338.
 McKim, L. H., 981.
 McKinley, G. Murray, 710, 718.
 McKnight, J. L., 845.
 McLean, Stafford, 984.
 McLester, James S., 100.
 McNamara, F. P., 823.
 McPeak (cited by W. Clarkson), 814.
 McPhedran, Maurice, 603, 824.
 McRae, Duncan, 599.
 McVicar, C. S., 855.
 McWhorter, John E., 690, 693.
 Macdonald, Ian, 480, 482.
 Mackenzie, W. D., 409, 800, 835, 987.
 Mackoy, Frank W., 960.
 Macky, K. S., 926.
 Macleod, A. Garrard, 403.

- Madsen, J. P. V., 465.
 "Madura foot," 979, 980.
 Magnuson, Paul B., 926.
 Magrou, J., 718.
 Maier, R. J., 335, 338, 431, 616, 625, 830, 972, 976, 1018, 1030.
 Mailhes, R. J., 583.
 Major, Robert C., Lesions of upper humerus, 224.
 Malacia, secondary post-traumatic, 978.
 Malignancy of body of uterus, O. L. Norsworthy (abstract), 590.
 Malignancy, Skin: comments on therapy, R. H. Stevens, 435.
 Malignancy, varying degrees of, Multiple adenopapillomata of stomach, with report of case showing, F. D. Ackman (abstract), 103.
 Malignant conditions of colon, Diagnosis of, F. W. Rankin (abstract), 998.
 Malignant conditions of mouth and lips, Early diagnosis and treatment of, F. A. Figi (abstract), 985.
 Malignant disease, blood cholesterol in. Further studies of effect of radiation on, W. L. Mattick and M. C. Reinhard (abstract), 575.
 Malignant growths, Palliative radiotherapy of, F. C. Wood, 291.
 Malignant tumors of thyroid gland, C. Williams (abstract), 432.
 Malkin, T., 596.
 Mall, Franklin P., 263, 270, 334, 338.
 Mallinckrodt, Edward, Institute of Radiology, 75.
 Mallory (cited by F. J. Cotton), 658.
 Malugani, Pietro C., 822.
 Mandeville, Frederick B., 93, 404, 423, 430, 431, 577, 598, 608, 615, 793, 802-804, 807, 825, 828, 984, 986, 1017.
 Mandruzzato, F., 928.
 Manges, Willis F., 1022.
 Manheimer, Olga. *See* Becker-Manheimer, Olga.
 Manitoba Sanatorium, 599.
 Mann, Frank C., 619.
 "Marble bones," 162, 164, 165, 167, 168.
 Marchand (cited by C. E. Weaver), 64.
 Margolis, Harry M., 1026.
 Marie, T., 300.
 Martin, Albéric, 422.
 Marinelli, L., 29, 82, 86, 92, 96-100, 104, 400, 404, 406, 407, 422, 426, 599, 615, 617, 806, 823, 829, 837, 993.
 Marinus, Carlton J., 52, 58.
 Mariupolsky, A., 579.
 Mark, Ernest G., Uroselectan as medium for vesiculographic study: preliminary report, 933.
 Mark, H., 779.
 Markovits, Emmerich, 83.
 Marks, Jerome A., 101.
 Marshall, H. W., 242.
 Marshall, James M., 785.
 Martenstein, Hans, 704.
 Martin, A. M., 242.
 Martin, Charles L., 415, 798.
 Martin, Douglas D., 822.
 Martin, Hayes E., 592.
 Martin, H. G., 553.
 Martin, James L., 73, 743.
 Martin, James M., 377, 881-892.
 Martin, J. M., Radiation therapy in treatment of cancer of mouth and lips, 881. *See other references.*
 Martius, Heinrich, 926.
 Marxer, O. A., 31, 32, 34, 37.
 Mason, R. L., 495, 507.
 Master, A. M., 1010.
 Masterson, John J., 73.
 Mastoids—oblique, antero-posterior, sagittal incidence, symmetric images of, Procedure for obtaining, C. Crespellani (abstract), 404.
 Mastoids, Roentgen examination of paranasal sinuses and, A. Granger (abstract), 814.
 Maternity care, Role of radiography in, W. A. N. Dorland (editorial), 561.
 Maternity Center Association, 561.
 Matthews, Harvey B., 799.
 Mattick, Walter L., 575, 1019.
 Matz, Philip B., Study of bone tumors among ex-service men, 664.
 Matzner, Milton J., 97.
 Mauclore, Pl., 926.
 Maughan, G. H., 740, 743.
 Maxwell, Harvey Cecil, 927.
 Maxwell, J. Preston, 410.
 Mayer, Edgar, 740, 742, 743.
 Mayer, Edmund, 836.
 Mayer (cited by B. L. Wyatt), 826.
 Mayo Clinic, 37, 97, 98, 204, 422, 480, 481, 484, 582, 583, 601, 669, 786, 820, 847, 851, 936, 985, 1003.
 Mayo (cited by W. L. Hearst), 582.
 Mazumder, K. C., 594.
 Measurements, Absorption, of X-ray general radiation, L. S. Taylor, 302.
 Measurements, radiation, Meteorological-medical, in defined regions of the spectrum, K. Büttner (abstract), 806.
 Measurements of half value layer in aluminum, H.-T. Meyer (abstract), 805.
 Measurement of high constant or rippled voltages, Apparatus for, Lauriston S. Taylor, 893.
 Meckel's cartilage, 220.
 [Mediastinum] Emyema, Posterior mediastinal, perforating into bronchus, Q. Vischia (abstract), 95.
 Mediastinum, Lipoma of, W. M. Yater and E. S. Lyddane (abstract), 829.
 [Mediastinum] Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, Eugene Freedman, 14-29.
 Mediastinum, superior and posterior, Roentgenological study of, S. Brown and H. G. Reinecke (abstract), 990.
 Medical Care, Costs of, Committee on, 388.
 Mehl, Robert F., Doan, Gilbert E., and Barrett, Charles S., Radiography by use of gamma rays, 508.
 Mehl, Robert F., joint-author, 461.
 Meigs, Joe V., 831.
 Meisels, Emil L., 927.
 Meisels, L., 927.
 Meisenbach, Roland O., 234, 242.
 Meland, Orville N., 90, 91.
 Melchart, Franz, 1020.
 Meller, Oskar, 620.
 Mellon, Ralph R., 710, 718.
 (Meloreostosis) eburnizing osteitis of single bone, Case of, A. Piergrossi (abstract), 977.
 Melorheostosis (Léri) and generalized osteitis condensans or osteopoikilia (Albers-Schönberg), A. Kahlstorf (abstract), 580.
 Meltzer-Lyon test, 98.
 Menagh, F. R., 329, 330, 332.
 Menard, O. J., 802.
 Menees, Thomas O., 401, 799.
 Mengle, H. A. K., 546.
 Menke, H., 780.
 Menopause, menorrhagia of, and uterine fibroids, Further report on X-ray treatment of, L. J. Carter, 44-46.
 Menorrhagia and irregular uterine hemorrhage, Radium in treatment of, M. Donaldson (abstract), 408.

- Menorrhagia of menopause and uterine fibroids, Further report on X-ray treatment of, L. J. Carter, 44-46.
- Menstrual headaches, Radiation therapy in, C. L. Martin (abstract), 415.
- Mentzer, Stanley, 680.
- Menville, Leon J., 825, 846, 960, 998.
- Menopause, therapeutic, Low voltage X-ray for, J. C. Potter (abstract), 798.
- Merklen, Pr., 927.
- Merlo Gomez, Jose F., 927.
- Merritt, E. A., 814.
- Mesz, Natan, 579.
- Metropolitan Life Insurance Company, 561.
- Metzger, Irvin D., Roentgenology and internship (editorial), 68-70.
- Metzger, —, 621.
- Meyer, Heinz-Theodor, 798, 805.
- Meyer, Hermann, 927.
- Meyer, Jacob, 625.
- Meyer, Willy, 773.
- Meyer (cited), 463, 467, 512, 517, 585.
- Meyer-Borstel, H., 986.
- Meyerding, Henry W., 179, 180, 242, 669, 671, 672, 678, 820, 927.
- Meynadier, E., 927.
- Michael, Jeffrey C., 341, 345.
- Michailovsky, N., 746, 751.
- Middleton, W. S., Pohle, E. A., and Ritchie, Gorton, Adenocarcinoma of bronchus, with widespread metastases: case report, 945.
- Miescher, G., 732, 736.
- Miescher (cited by L. Freund), 1013.
- v. Mikulicz (cited), 585, 684.
- Milani, —, 961.
- Miller, Hiram E., 345.
- Miller, J. Duane, 401.
- Miller, O. L., 981.
- Miller, Sydney R., 390, 785.
- Miller, S. W., 819.
- Miller (cited by H. B. Matthews), 799.
- Milles, G., 1002, 1004.
- Mills, Nathaniel, 918, 927.
- Mills (cited by J. Friedenwald), 99.
- Millstone, Henry J., 933, 935.
- Minnesota Radiological Society, 73, 564.
- Minot, George R., 692, 693.
- Miranda, Francisco de P., 772.
- Misske, Bruno, 607.
- Mitchell, J. K., 983.
- Mitchell, S. Weir, 983.
- Mitchell, William, 602.
- Moeller, A., 834.
- Moglia, Giovanni, 1009.
- Moles, 441.
- Moles, Cancerous, S. J. Wilson (abstract), 988.
- Möller, H., 594.
- Momm, W., 936, 940.
- Monod, Octave, 89.
- Monroe, Robert T., 480, 482, 787.
- Montanari, Arrigo, 394.
- Montgomery, A. H., 543.
- Montgomery (cited by H. Rudisill, Jr.), 942, 943.
- Mooney, Bernard R., 335, 338.
- Moore, Alexander B., 97, 609, 853, 855.
- Moore, Beveridge H., 927.
- Moore, John R., Tumors of os calcis, 232.
- Moore, Sherwood, 67, 612.
- Moore, Thomas D., 1005.
- Mora, J. M., 984, 1017.
- Moran, H. M., 808.
- Moreau, Ch., 481, 482.
- Moreau, L., 927.
- Morel (cited by G. Rotolo), 576.
- Morel-Kahn, —, 960.
- Morelle, Jean, 982.
- Morestin, H., 242.
- Morgan, Hugh J., 600.
- Morgan, William Gerry, 391.
- Mörikofer, W., 547.
- Morlock, H. V., 601.
- Morris (cited by W. W. Belden), 921.
- Morrison, L. B., 86.
- Morrow (cited by R. D. Spangler), 359, 361.
- Morse, P. F., 66.
- Morse, Sterne, 322, 324, 327.
- Mortimer, Bernard, Experimental hyperthermia induced by high frequency current, 705.
- Morton, S. Archibald, joint-author, 328; 411, 564.
- Morton (cited by Krebs, C., Rask-Nielsen, H. C., and Wagner, A.), 565.
- Mosenthal, —, 85.
- Mouchet, Albert, 925, 927.
- Mouth and lips, malignant condition of, Early diagnosis and treatment of, F. A. Figi (abstract), 985.
- Mouth and lips, cancer of, Radiation therapy in treatment of, J. M. Martin, 881.
- Mouth, cancer of, Radiation therapy in, with especial reference to use of pure gamma rays, G. E. Pfahler and J. H. Vastine (abstract), 988.
- [Mouth] Intra-oral cancer and its treatment, A. Soiland and O. N. Meland (abstract), 91.
- Mucosa, Roentgenologic demonstration of, by means of umbrathor: contribution to roentgenologic diagnosis of ulcerative colitis, H. Regelsberger (abstract), 95.
- Muff, Walther, 334, 338.
- Muir, John, 616.
- Mull, Wilhelm, 927.
- Müller, Alex, 596.
- Müller, A., 360, 927.
- Müller, C. H. F., 355.
- Müller, E. F., 703, 1002, 1004.
- Muller, George P., 495, 507.
- Müller, Sven, 927.
- Muller (cited), 405, 429, 571, 927.
- Mullin, W. V., 1023.
- Murchison (cited by N. Voorhoeve and H. W. Wiese), 480, 482.
- Murphy, Arthur J., 1003.
- Murphy, Douglas P., Irradiation and pregnancy (editorial), 771.
- Murphy, George T., 97.
- Murphy (cited by Krebs, C., Rask-Nielsen, H. C., and Wagner, A.), 565.
- Murray, Cecil D., 616.
- Murray, C. R., 742, 743.
- Murray (cited by W. B. Coley), 655.
- Mutscheller, A., 13, 303, 308, 312, 857.
- Muzii, Mario, 96, 941.
- Mycetoma, Maduromycotic (Madura foot): report of case occurring in American negro, J. W. Jones and H. S. Alden (abstract), 979.
- Myelitis, traumatic, Roentgenologic findings in series of seventy-two cases of, due to fracture of spine, E. S. Gurdjian (abstract), 819.
- Myeloma, Endothelial, or Ewing's sarcoma, W. B. Coley, 627.
- Myeloma, multiple, 159, 175-178, 185, 283.
- Myelomatosis in child of 8 years, P. Jacoby (abstract), 427.
- Myers, Jay A., 73.
- Myoma, gastric, Roentgenologic demonstration of, H. Gebhardt (abstract), 617.
- Myositis ossificans, 144, 145, 149, 151-154, 280.
- Myxosarcoma of bone, 137, 141, 142.

- Naegeli (cited by Krebs, C., Rask-Nielsen, H. C., and Wagner, A.), 565.
 Nähring, Erich, 782.
 v. Náray-Szabó, St., 782.
 National Tuberculosis Association, 803, 1031.
 Natta, G., 595, 783.
 Naujoks, H., 334, 335, 338, 405.
 Neeff, T. C., 12, 315, 401, 470, 611, 785.
 Neill, William, Jr., 590.
 Nell, W., 574.
 Nelson, W. C., 710, 718.
 Neoplasm, gastric, Epibronchial diverticulum of esophagus in patient affected by, M. Muzii (abstract), 96.
 Nephrolithiasis, Roentgenological control of exposed kidneys in operations for nephrolithiasis, with use of special intensifying cassette, E. Beer (abstract), 1007.
 Nessa, N. J., 335, 338.
 Neugebauer (cited by W. W. Belden), 916.
 Neuhoof, Harold, 693.
 Neurofibroma arising on pericardial pleura, W. L. Keller and G. R. Callender (abstract), 598.
 Neurology, Roentgen therapy in, 419.
 New, G. B., 222, 223.
 New York Dermatological Society, 701.
 New York Roentgen Society, 394.
 New York Surgical Society, 646.
 Newell, R. R., 4.
 Newman, Rollo K., 571.
 Neymann, Clarence A., 718, 993.
 Nichols, Bernard H., 73, 794.
 Nicolaysen, N. A., 927.
 Nicory, Clement, 835.
 Niedlich, W., 927.
 Nijkerk, N., 704.
 Nipple, bleeding, Contribution to radium therapy of, F. F. Dautwitz (abstract), 810.
 Nishina (cited by C. S. Barrett, R. A. Gezelius, and R. F. Mehl), 437.
 Nitrites, complex, Chemical and crystalline structure of several, A. Ferrari and C. Colla (abstract), 596.
 Nitrogen excretion in urine following roentgen and radium treatment, G. K. F. Schultze (abstract), 420.
 Nitrogen peroxide from mechanical rectifiers of deep X-ray therapy plant, R. K. Newman (abstract), 571.
 Noire, Henri, 322, 327.
 Nonnenbruch, —, 989.
 Nordstrom, L. O., 615.
 Norrish, R. G. W., 327.
 Norsworthy, O. L., 590.
 Northrop, John H., 327.
 Northwestern University Medical School, Chicago, 623.
 Northwestern University Medical School, Quarterly Bulletin of, 82.
 Nose, Radium therapy in cancer of, larynx, and esophagus, H. M. Moran (abstract), 808.
 Novak, Josef, 927.
 Nowakowski, A., 593.
 Nürnberger, Ludwig, 405.
 Nuvoli, Umberto, 394.
 Nuzzi, O., 927.
 Oberholt. See Overholt, Richard H.
 Oberlin, E. G., 535.
 O'Brien, E. J., 606, 826.
 O'Brien, W. A., 73.
 Obstetric diagnosis, Roentgen ray as an adjunct in, H. B. Matthews (abstract), 799.
 Obstetrics and gynecology, roentgenographic contrast diagnosis in, Newer methods of, J. Jarcho (abstract), 801.
 Obstetrics, roentgen diagnosis in, Results and value of, K. Heim (abstract), 1009.
 Odelberg, Axel, 270.
 Odessky, J., 576.
 Oertel, Horst, 86.
 Offspring, question of injury to, 110.
 Ohshima, K., 781.
 Oils, brominated, and brominated esters, Preparation of some, H. L. Wikoff (abstract), 992.
 Oils, brominated, Pharmacology of, C. S. Smith and H. L. Wikoff (abstract), 992.
 Oil, iodized rapeseed (campiodol): use in roentgenographic visualization of body cavities, M. A. Glaser (abstract), 992.
 Oil, iodized, Technic of intratracheal injection of, J. R. Head (abstract), 95.
 Oil, iodized, Use of, in diagnosis of nasal sinus conditions: Further observations, H. M. Good-year (abstract), 1023.
 Oils, radiopaque, Biliary tract visualization with, R. H. Overholt (abstract), 613.
 Oka, Mitsutomo, 95.
 Oliver, Robert Lee, Bone lesions of lower radius, 245.
 Olivier, E., 927.
 Ontario, Canada, pilicosis in, 604.
 Oögenesis, Histological study on effects of X-rays on ovary during period of, G. Gricouroff (abstract), 109.
 Ophthalmology, Roentgen therapy in, 419.
 Opie, Eugene L., 823.
 [Oral cavity] Intra-oral cancer and treatment, A. Soiland and O. N. Meland (abstract), 91.
 Orator (cited), 787, 851, 855.
 O'Reilly, Archer, 927.
 Ormond (cited), 1008.
 Orndoff, Benjamin H., 53.
 Orten (cited by C. E. Weaver), 64.
 Orton, L. H. H., 783.
 Os calcis, Fractures of, G. Rotolo (abstract), 576.
 Os calcis, Tumors of, John R. Moore, 232.
 Os naviculare pedis, Bilateral disease of, in adults, A. Wilke (abstract), 932.
 Osborne, Earl D., and Putnam, Edwin D., Treatment of warts, 340.
 Osborne, S. L., 718, 993.
 Osborne, Wilmoth A., 420.
 Osgood, Robert B., 975.
 Osler, Sir William, 785, 841.
 Osteitis chronica deformans Paget, atypical bone changes in, Contribution to question of, G. Bastian (abstract), 405.
 Osteitis condensans, generalized, or osteopoikilia (Albers-Schönberg), Melorheostosis (Léri) and, A. Kahlstorf (abstract), 580.
 Osteitis condensans generalisata. See Osteopoikilia.
 Osteitis deformans, 169-173.
 Osteitis deformans (Paget's disease), Discussion of some cases of, E. Conte (abstract), 406.
 Osteitis deformans (Paget), generalized, with secondary malignant degeneration, Case of, V. Genner and H. Boas (abstract), 578.
 Osteitis deformans: treatment by ultra-violet rays, C. Nicory (abstract), 835.
 Osteitis, eburnizing, of single bone (melorheostosis), Case of, A. Piergrossi (abstract), 977.
 Osteitis fibrosa, F. J. Cotton, 657.
 Osteitis fibrosa localisata, A. R. Kilgore and L. H. Garland, 679.
 Osteoarthropathy, Hypertrophic pneumie (Pierre Marie), C. Blumensaat (abstract), 992.
 Osteochondritis dissecans, considered from X-ray viewpoint, G. Jansson (abstract), 578.

- Osteitis fibrosa, 132, 133.
 Osteitis fibrosa cystica generalisata, Case of, R. Kienböck, and E. Markovits (abstract), 83.
 Osteitis, Garré's non-suppurative, 126-129, 134, 146, 147.
 Osteochondromas, 112-117.
 Osteochondromas, Congenital exostoses and their transformation into, Mosenthal (abstract), 85.
 Osteogenesis imperfecta, 165-167.
 Osteology, pathologic, Contributions to: (A) unilateral patella partita; (B) joint formation in body of first rib, A. Pickham (abstract), 573.
 Osteoma of frontal sinus, R. O. Leavenworth (abstract), 815.
 Osteomalacia, 176-178.
 Osteomalacia and fetal rickets, J. P. Maxwell (abstract), 410.
 Osteomalacia, Lunate, E. S. Blaine (abstract), 978.
 Osteomyelitis, 137-140, 146, 147, 222.
 Osteomyelitis, metastatic, 166.
 Osteomyelitis, non-suppurative, 246.
 Osteomyelitis, Non-suppurative, L. Clarence Cohn, 187.
 Osteomyelitis, subacute, of femur, resembling sarcoma, Report of five cases of, G. A. Stewart, 271.
 Osteomyelitis variolosa: report of three cases, J. F. Le Cocq (abstract), 977.
 Osteopoikilia, Case of, G. Gr. Awalischwili (abstract), 83.
 Osteosarthyrosis, Idiopathic, L. Prussak and N. Mesz (abstract), 579.
 Osteosarthyrosis, idiopathic, 166.
 Otology, Roentgen therapy in, 419.
 Ott, Emil, 782.
 Ott, Theo, 927.
 Ottaviani, Gaetano, 1010.
 Otten, M., 16, 28.
 Ottonello, Pietro, 29, 101, 427.
 Oudard (cited by W. W. Belden), 927.
 Ovarian disorders, functional, Irradiation therapy in, F. A. Ford, 936.
 Ovary and peritoneum, endometrial tumors of, Temporary amenorrhea in treatment of, H. Albrecht (abstract), 109.
 Ovary during period of oögenesis, Histological study on effects of X-rays on, G. Gricoureff (abstract), 109.
 Overholt, Richard H., 499, 507, 605, 613, 994.
 Oxygen injection into joint, Tuberculosis of knee joint, demonstrated by, B. Ulrichs (abstract), 433.
 Pack, George T., 591, 813, 1018.
 Packard, Charles, 553, 611, 698, 704.
 Packard, George B., 652, 653.
 Page, A. B., 711, 719, 736.
 Paget, Sir James, 172, 180, 188, 694.
 Paget's disease, 170, 172, 173, 188, 189, 193, 195-197, 406, 578, 657-659, 679, 682, 694-696.
 Paget's disease of bone, Harvey Smith, 694.
 v. Páll, Gabriel, 927.
 Pallasse (cited by W. W. Belden), 927.
 Palmer, Bean M., 806.
 Palmer, L. A., 638, 644, 653.
 Palmer, J. P., 990.
 Palmer, Myron B., 927.
 Palmieri, A., 927.
 Palugay, Josef, 107, 996, 1022.
 Pan-American Medical Association, Program of Third Congress of, 772.
 Pancoast, Henry K., 423, 600, 821, 966.
 Pancreas, acute necrosis of, Diagnosis and therapy of, R. Ehrmann (abstract), 99.
 Pansdorf, H., 100.
 Paralysis, infantile, Importance of encephalography for diagnosis and therapy of, L. Guttmann (abstract), 422.
 Parathyroid glands and thyroid, Effect of X-rays on, O. M. Walters, B. J. Anson, and A. C. Ivy, 52, 58.
 Paraurethritis, S. J. Silbar (abstract), 793.
 Pardoll, Davis H., 104, 790-793, 795-797, 1002-1007, 1009.
 Parenti, Silvio, 993.
 Parhon, C. I., 1024.
 Parhon-Stefanescu, Constance, 1024.
 Paris, cancer treatment in, 377, 378.
 Paris, University of, Radium Institute of, 88, 573.
 Paris, University of, Radium Institute of, Radio-physiological and medical sections of, C. Regaud (abstract), 535.
 Parker, Morris L., 625.
 Parotiditis, post-operative: Treatment without and with radium, F. W. Rankin and B. M. Palmer (abstract), 806.
 Parry, Leo D., 546.
 Pars petrosa, anatomy and of semeiotics of, Radiographic researches of technic of, A. Ratti (abstract), 422.
 Partsch (cited by Richard F. C. Kegel), 220, 223.
 Pasteur, W., 507.
 Patch, Frank S., 107, 790.
 Patella, bone cyst of, Final report on case of, Wallace H. Cole, 752.
 Patey, D. H., 499, 507.
 Patrick, L. E., 815.
 Patterson Screen Company, 771.
 Paul, John R., 145, 179.
 Pauling, Linus, 595, 597, 779.
 Paulson, Moses, 904.
 Pausdorf, Hans, 574.
 Peabody, C. W., 927.
 Pearl, Raymond, 98.
 Peck, Willis S., Educational problems in physical therapy, 726.
 Pediatrics, Actinotherapy in, G. La Pierre (abstract), 1016.
 Pediatrics, Application of radiology to practice of, with indications and contra-indications, W. L. Mattick (abstract), 1019.
 Peck, F. W., 893.
 Pellegrini, Augusto, 927.
 Pelvic inflammatory diseases, Roentgen therapy of subacute and chronic, L. Seitz (abstract), 416.
 Pelvis and maternal mortality, F. Stoney (abstract), 400.
 Pelvis, metastasis to vertebræ and bones of, from carcinoma of breast, Roentgen treatment of, E. T. Leddy (abstract), 811.
 Pemberton, John de J., 430.
 Pemberton, Ralph, 975, 976.
 Pendergrass, Eugene P., 507, 821, 978, 1024.
 Penfield, Wilder, 425.
 Pennsylvania, state of, intern law in, 68.
 Perioistitis, non-suppurative, 182.
 Periostitis, ossifying, 146-148, 155, 280.
 Peritoneal cavity, Air in: effect on position and activity of diaphragm, R. H. Overholt (abstract), 994.
 Peritoneum and ovary, endometrial tumors of, Temporary amenorrhea in treatment of, H. Albrecht (abstract), 109.
 Perona, Pietro, 1010.
 Perotti, C., 927.
 Perotti, Desiderio, 426.
 Persson, Elis, 781.
 Perthes, J., 58.
 Perussia, Felice, 407.

- Pescatori, Guido, 598.
 Petersen, B. W., 327.
 Petersen, W. F., 1002, 1004.
 Peterson, Charles H., 623.
 Peterson (cited), 973.
 Pette, H., 927.
 Peyer's patches, 264.
 Pfahler, George E., 58, 91, 420, 443, 536, 546, 553, 589, 739, 743, 891, 892, 967, 988, 1017.
 Pfeiffer, C., 52, 57.
 Pfeiffer (cited by B. Misske and A. Sylla), 607.
 Phelps, W. M., 740, 743.
 Phemister, D. B., 179, 537.
 Photography, intragastric, Diagnosis of gastric lesions by: preliminary report, R. Finkelstein (abstract), 620.
 Phragmen (cited), 594, 597.
 Physical therapy and radiotherapy during 1929, C. R. Brooke (abstract), 29.
 Physical therapy, Biophysical principles of, K. W. Stenstrom, 730.
 Physical therapy, Educational problems in, Willis S. Peck, 726.
 Physical therapy, Symposium on, Ernst A. Pohle, 725.
 Physikalisch-Technischen Reischanstalt, 12.
 Physiotherapy, Historical background of (abstract), 1014.
 Pickett, Lucy W., 322, 326, 327.
 Pickhan, A., 575.
 Picot (cited by W. W. Belden), 927.
 Piergrossi, Aldo, 977.
 Pietrantoni, Luigi, 823.
 Pilon, H., 74.
 Pincoffs, Maurice C., 390.
 Pincussen, Ludwig, 574.
 Pine, Mary, 509, 513.
 Piney, Alfred, 180, 199, 208, 210.
 Pinzani (cited by H. Naujoks and H. I. Teperson), 334, 338.
 Piper, S. H., 596.
 Pittoni, Ezio, 927.
 Plank, T. H., 210.
 Platau (cited by R. H. Jamieson and F. Hernaman-Johnson), 810.
 Platt, Harry, 984.
 Plaut, Alfred, 660, 663.
 Plenk, Andreas, 270.
 Pleuritis carcinomatosa and sarcomatosa exudativa, Radiation therapy of, I. Heeren (abstract), 418.
 Plewes, D. F., 830.
 Pomeranz, R., 991.
 Pneumocephalus, Traumatic, S. W. Miller, R. N. Klemmer, and P. O. Snoke (abstract), 819.
 Pneumocephalus, Traumatic: report of 8 cases, C. W. Rand (abstract), 424.
 Pneumo-encephalography, Studies in, F. J. Farnell, S. F. H. Howes, and J. B. Hudson (abstract), 423.
 Pneumonia, Fibrinous, with partial lobar consolidation, M. Viamonte (abstract), 92.
 Pneumonia, lobular (bronchopneumonia), Roentgenologic appearance of, N. W. Potte (abstract), 94.
 [Pneumonia] Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, Eugene Freedman, 14-29.
 Pneumothorax, cardiac pulsation in, Further studies on, A. Vallebona (abstract), 599.
 Pneumothorax cavities, artificial, Fibrin bodies in, or pleural mouse, H. V. Morlock and F. G. Wood (abstract), 601.
 Pneumothorax, Congenital: review of literature and report of case, J. Stein (abstract), 92.
 Pneumothoraces, Localized, as cause of annular shadows in roentgenograms of chest, W. P. Warner (abstract), 601.
 Pneumothorax, Spontaneous, J. P. Palmer and R. B. Taft (abstract), 990.
 Podestà, Vittorio, 571, 839.
 Podkaminsky, N. A., 413.
 Podlasky, H. B., 430.
 Pohl, Rudolf, 573.
 Pohle, Ernst A., 89, 110, 302, 308, 317-319, 400, 401, 404, 405, 407, 408, 411-418, 420-422, 426, 432, 445-460, 491, 547, 571, 572, 574, 575, 587, 590, 611, 719, 736, 737, 739, 743, 784, 785, 798, 799, 802, 805, 806, 808, 810, 811, 813, 814, 826, 827, 829, 833, 835, 836, 838-840, 904, 941, 945-948, 973, 974, 991, 994, 995, 1013, 1018, 1022, 1029.
 Pohle, Ernst A., Symposium on physical therapy, 725.
See other references.
 Pohle, E. A., Ritchie, Gordon, and Wright, C. S., Studies of effect of roentgen rays on healing of wounds. I. Behavior of skin wounds in rats under pre- and post-operative irradiation, 445.
See other references.
 Polano, O., 400.
 Pollack, Herbert, 87.
 Pólya, Eugene, 891.
 Polycythemia vera, Radiation therapy of, G. T. Pack and L. F. Craver (abstract), 813.
 Pope, Charles, 563.
 Popoff, B. P., 928.
 Porchovnik, J. B., 415.
 Porro, N., 577.
 Portmann, Georges, 392.
 Portmann, U. V., 4, 8, 304, 703.
 Post, W. E., 541.
 Potassium in radiobiology, P. Ottonello (abstract), 29.
 Potenza, Vito, 98.
 Potte, N. W., 94.
 Potter, J. Craig, 798.
 Potter (cited by H. C. Bumpus, Jr.), 790.
 Powell, Barton J., 612.
 Pozzo, Mario V., 928.
 Prasad, Mata, 779.
 Pratt, G. P., 480, 482.
 Pray, Ralph E., 1027.
 Pregnancy after radium therapy for cervical carcinoma: Cesarean hysterectomy at eighth month, G. B. Contardo (abstract), 1009.
 Pregnancy, Irradiation and, Douglas P. Murphy (editorial), 770.
 Pregnancy, X-rays in, Some notes on value of, H. R. Sear (abstract), 1009.
 Presser, Karl, 851, 855.
 Price, Charles W., 818.
 Prickett, C. J., 75.
 Priddle, W. W., 601.
 Prince, Howard L., 244.
 Prins, J. A., 780, 783.
 Pritchard, Stuart, 822.
 Protection against radiant energy, Concerning question of protective lead thicknesses in international recommendations and German ordinances regarding, R. Glocker (abstract), 406.
 Protection against radiant energy, Thickness of lead protection in German ordinances regarding, J. H. van der Tuuk and W. H. Boldingh (abstract), 406.
 Protozoa, Effect of barium sulphate upon incidence of human intestinal, J. Andrews and M. Paulson (abstract), 904.
 Prussak, Leon, 579.
 "Prussian disease," 144.
 Pryor, John H., 507.

- Psoriasis, Multiple X-ray carcinomas following: Case report and comment, H. Goodman and C. W. Price (abstract), 818.
- Psychiatry, Roentgen therapy in, 419.
- von Puech (cited by H. I. Teperson), 334.
- Pulvirenti, M. S., 928.
- Pusch, Gerhard, 928.
- Pusch, Lewis C., Relation between histologic structure and prognosis in sarcoma of skin and fascia, 660.
- Putnam, Edwin D., joint-author, 340.
- Putti, V., 928, 977.
- Pyelographic image after injection of uroselectan, L. Turano (abstract), 104.
- Pyelography, cystographic, Comparative value of uroselectan, R. H. Herbst (abstract), 1004.
- [Pyelography] Examination of urinary ducts, with new substance intravenously injected, D. Tagli (abstract), 104.
- Pyelography, Excretion, with abrodil, H. Bronner and J. Schueller (abstract), 792.
- Pyelography, Intravenous, A. Laroche (abstract), 108.
- Pyelography, intravenous, in pathological conditions of kidneys, Experimental research concerning, G. Gabriel (abstract), 791.
- Pyelography, intravenous, Uroselectan for, J. C. McClelland (abstract), 1006.
- Pyloric and prepyloric deformities, Roentgenologic significance of, J. D. Camp, 847.
- Pyloric stenosis, Hypertrophic, in adults: roentgen aspects, V. W. Archer (abstract), 99.
- Plorus, carcinoma of, early, Contribution to diagnosis of, H. Meyer-Borstel (abstract), 986.
- [Pylorus] Pyloric stenosis, hypertrophic, Some interesting cases of, R. R. MacGregor (abstract), 999.
- Pytel, A. J., 427.
- "Quality" of X-ray tube and how to measure it, A. Bouwers, 353.
- Quick, Douglas, 91, 548, 553, 587, 588, 591, 592, 891, 1017.
- Quigley, D. T., What shall we teach public in regard to cancer and how shall we present it? 369.
- Quimby, Edith H., 13, 302, 308, 310, 317, 327, 592, 867, 967, 1007.
- Quinn, Claude E., 394.
- r-unit, definition of, 1.
- r-unit, work at University of Freiburg to determine, 973.
- Raderma cream, 422.
- Radiations, biological action of, Further studies on, of different wave lengths, E. Conte (abstract), 837.
- Radiation, blue-gray bright spot, of Lilienfeld-Roentgen tubes, New investigation on, F. Rother and W. M. Cohn (abstract), 780.
- Radiation dosimetry, bio-electric, Ways and aspects of (second communication): Measuring of polarization and radiation stimuli, H. Regelsberger (abstract), 405.
- Radiation, economic aspect of, 299.
- Radiation from wireless valves, H. M. S. Turner (abstract), 719.
- Radiation, Hairy tongue following adjacent, M. T. Van Studdiford (abstract), 808.
- Radiation injuries to skin, Possibility of preventing, E. Uhlmann (abstract), 422.
- Radiation measurements, Meteorological-medical, in defined regions of spectrum, K. Büttner (abstract), 806.
- Radiation on blood cholesterol in malignant disease, Further studies on effect of, W. L. Mattick and M. C. Reinhard (abstract), 575.
- Radiation, Penetrating, in atmosphere, M. H. Schulze (abstract), 404.
- Radiation, reaction of albumin to, Time factor of, W. Gentner (abstract), 839.
- Radiation, Sources of, and their physical characteristics, W. W. Coblenz (abstract), 838.
- Radiation, Stem, air absorption, and inverse square law, H. Hase and H. Küstner (abstract), 904.
- Radiation therapy in cancer of mouth, with special reference to use of pure gamma rays, G. E. Pfahler and J. H. Vastine (abstract), 988.
- Radiation therapy in carcinoma with fractional doses, Present methods and results of, L. Freund (abstract), 415.
- Radiation therapy in menstrual headaches, C. L. Martin (abstract), 415.
- Radiation therapy in toxic goiter, Results of, P. Jaguttis (abstract), 1028.
- Radiation therapy in treatment of cancer of mouth and lips, J. M. Martin, 881.
- Radiation therapy of carcinoma, Auxiliary methods in, H. Hirsch (abstract), 415.
- Radiation therapy of pleuritis carcinomatosa and sarcomatosa exudativa, I. Heeren (abstract), 418.
- Radiation therapy of polycythemia vera, G. T. Pack and L. F. Craver (abstract), 813, 1018.
- Radiation therapy of thrombophlebitis, J. Halban (abstract), 811.
- Radiation therapy of tumors of pituitary body, Radiological diagnosis and, Q. Vischia (abstract), 829.
- Radiation treatment, combination isamin blue, Experience with, H. Cramer (abstract), 412.
- Radiation treatment of carcinoma, Present methods of, and results: III.—Saturation method of Pfahler and Kingery, H. Holfelder (abstract), 589.
- Radiation treatment in myelogenous leukemia, S. Hammerschlag and H. Knospe (abstract), 418.
- Radiation, ultra-violet, Biologic test of, emitted by Vitalux lamp, L. Böhmner (abstract), 838.
- Radiation, ultra-violet, in infants with tetany, Dosage of, H. Bakwin and R. M. Bakwin (abstract), 834.
- Radiation, ultra-violet, on tissue cultures, Effect of, E. Mayer (abstract), 836.
- Radiation, X and gamma, upon aqueous solutions of iodine and potassium iodide, Action of, G. Harker (abstract), 783.
- Radiation, X-ray general, Absorption measurements of, L. S. Taylor, 302.
- Radiobiology, Potassium in, O. Ottonello (abstract), 29.
- Radiographic aspects of laryngeal tuberculosis, L. Feci and L. Pietrantonio (abstract), 823.
- Radiographic method, New, for study of cervical vertebrae, P. Ottonello (abstract), 427.
- Radiographs, mediastinal, Thymus problem to date, based on study of 475, J. H. West (abstract), 1027.
- Radiography by gamma rays, Technic of, C. S. Barrett, R. A. Gezelius, and R. F. Mehl, 461.
- Radiography by use of gamma rays, R. F. Mehl, G. E. Doan, and C. S. Barrett, 508.
- Radiography, Cranial, E. Dufresne (abstract), 1025.
- Radiography in maternity care, Rôle of, W. A. N. Dorland (editorial), 561.
- Radiologic aspect of lungs and valvular defects of heart, G. Balestra and A. Ghio (abstract), 92.
- Radiologic examinations in past six years, Some considerations of 4,600, M. Muzii (abstract), 941.

- Radiologic technic, radiations in, Effect of intensifying screens in relation to quality of, V. Podestà (abstract), 571.
- Radiological aid in study of chronic colitis, A. Gavazzeni (abstract), 100.
- Radiological aspects of duodenal mobility, V. Dall'Acqua (abstract), 99.
- Radiological control on duodenal drainage, Importance of, G. Chizzola (abstract), 98.
- Radiological diagnosis and radiation therapy of tumors of pituitary body, Q. Vischia (abstract), 829.
- Radiological diagnosis of duodenal ulcer, A. Anzi-lotti (abstract), 98.
- Radiological diagnosis of duodenal ulcer, P. Buisson, M. Bermond, and M. Buisson (abstract), 617.
- Radiologic observations on tuberculous lobitis, Clinical and, P. C. Malugani (abstract), 822.
- Radiological signs of early cancer of stomach, A. Salotti (abstract), 86.
- Radiological study of stenotic affections of esophagus, New technic for, G. Chizzola (abstract), 96.
- Radiologists, blood of, Researches on, J. Lavedan (abstract), 573.
- Radiologist, Requirements of clinician from, and *vice versa*, G. B. Batten (abstract), 686.
- Radiology and medicine, Relationship between, W. Clarkson, 491.
- Radiology, Application of, to practice of pediatrics with indications and contra-indications, W. L. Mattick (abstract), 1019.
- Radiology as career, T. A. Groover, 841.
- Radiosensitivity of cells, Relation between division rate and, C. Packard (abstract), 553.
- Radiotherapy for inflammatory conditions, A. U. Desjardins (abstract), 1018.
- Radiotherapy, in adenocarcinoma of uterus, Results of, A. Lacassagne (abstract), 88.
- Radiotherapy in sarcoma, Indication for, A. Lacassagne (abstract), 985.
- Radiotherapy in treatment of basal-cell epithelioma of skin, Electrodesiccation *versus*, G. Archambault and A. Marin (abstract), 422.
- Radiotherapy, Lymphoma malignum (Hodgkin's disease) and lymphosarcoma: Pathogenesis, and prognosis, I. Levin (abstract), 1012.
- Radiotherapy, microbial flora of carcinoma of cervix and their importance in, study of, R. Vincent and O. Monod (abstract), 89.
- Radiotherapy of carcinoma of uterine cervix at Radium Institute of Paris, A. Lacassagne (abstract), 88.
- Radiotherapy, Palliative, of malignant growths, F. C. Wood, 291.
- Radiotherapy, Physical therapy and, during 1929, C. R. Brooke (abstract), 29.
- Radiotherapy, Specific radiosensitiveness of lymphocytes—its significance in, A. U. Desjardins (abstract), 412.
- Radium, action of, on certain micro-organisms, Experimental investigations of, G. Galli and A. Foà (abstract), 407.
- Radium, amount in U. S., 462.
- Radium and roentgen injuries, Promising ways to cure of hopeless, K. Graninger (abstract), 941.
- Radium and roentgen therapy in advanced cancer, with various combinations of wave lengths, Clinical evaluation of, B. P. Widmann and J. L. Weatherwax (abstract), 585.
- Radium and roentgen treatment, Nitrogen excretion in urine following, G. K. F. Schultze (abstract), 420.
- Radium and roentgen treatment, Systemic changes in patients with carcinoma of uterus, following, E. O. Gaessler (abstract), 89.
- Radium and surgery in cancer of tongue, D. Quick (abstract), 592.
- Radium application limited to fundus uteri, G. Ka-both (abstract), 408.
- Radium, Detection, estimation and elimination of, in living persons given radium chloride internally (II), H. H. Barker and H. Schlundt (abstract), 807.
- Radium emanation plant, New model, A. J. Allen (abstract), 571.
- [Radium] Gamma rays, Radiography by use of, R. F. Mehl, G. E. Doan, and C. S. Barrett, 508.
- Radium, gamma rays of, Comparison of biologic effect of roentgen rays and, R. Braun (abstract), 411.
- [Radium] Gamma rays, pure, Radiation therapy in cancer of mouth, with especial reference to use of, G. E. Pfahler and J. H. Vastine (abstract), 988.
- [Radium] Gamma rays, radiography by, Technic of, C. S. Barrett, R. A. Gezelius, and R. F. Mehl, 461.
- Radium, graded doses of, Biological investigations concerning effect of, on skin, A. Reisner (abstract), 406.
- Radium, Immunological and biochemical researches on biological action of X-radiation and, L. Cap-pelli (abstract), 806.
- Radium in gynecology, S. Forsdike (abstract), 799.
- Radium in superficial face lesions, W. A. Chernosky (abstract), 810.
- Radium in treatment of diseases of thyroid gland, Value and place of, S. Ginsburg (abstract), 1028.
- Radium in treatment of menorrhagia and irregular uterine hemorrhage, M. Donaldson (abstract), 408.
- Radium, in uterine diseases, and its use, W. E. Gary (abstract), 808.
- Radium irradiation, Biological effects of, R. G. Canti (abstract), 407.
- Radium surgery, Present status of, H.-G. Zwerg (abstract), 808.
- Radium therapy for cervical carcinoma, Pregnancy after: Cesarean hysterectomy at eighth month, G. B. Contardo (abstract), 1009.
- Radium therapy in advanced cases of cutaneous carcinomata, Efficacy of, F. Perussia (abstract), 407.
- Radium therapy in cancer of the nose, larynx, and esophagus, H. M. Moran (abstract), 808.
- Radium therapy of bleeding nipple, Contribution to, F. F. Dautwitz (abstract), 810.
- Radium therapy, Relative value of roentgen and, R. H. Crockett (abstract), 812.
- Radium therapy, Treatment of intra-oral cancer, with special reference to, D. Quick (abstract), 591.
- Radium treatment, Cosmetic results of electrocoagulation, especially of carcinoma of skin, A. Buschke and L. Loewenstein (abstract), 807.
- Radium treatment of buccal carcinoma, Principles of and some results in, G. E. Birkett (abstract), 590.
- Radium treatment of early epithelioma of lip, H. Hailey (abstract), 807.
- Radium treatment of cancer of tongue (symposium), Stanford Cade (abstract), 587.
- Radium treatment of cancer of tongue, S. Cade (abstract), 591.
- Radium treatment of primary carcinoma of breast, G. Keynes (abstract), 1015.

- Radium treatment of warts, 341 *et seq.*
 Radium, Treatment without and with: Post-operative parotiditis, F. W. Rankin and B. M. Palmer (abstract), 806.
 Radium, use of, Gynecological notes, with special reference to, K. Wilson (abstract), 807.
 Radium, uterine carcinomata treated with, Bacterial flora in, A. M. Bonanno (abstract), 407.
 Radiumhemmet, Stockholm, Sweden, 833, 932, 1021.
 Radiumhemmet in Stockholm, Results of treatment in: Comparison of results with those of other institutes, F. Melchart (abstract), 1020.
 Radius, giant-cell tumor of lower right, Case of recurrent, J. Shelton Horsley, 756.
 Radius, head and neck of, fractures of, Treatment of, J. A. Key (abstract), 982.
 Radius, lower, Bone lesions of, Robert Lee Oliver, 245.
 Raeth (Räth) (cited by W. F. Braasch), 108.
 Raiford, Theodore S., Tumors of small intestine: diagnosis, with special reference to X-ray appearance, 253.
 Rajewsky, Boris, 2, 571, 704.
 Raman (cited by K. Banerjee), 594.
 Ramanathan (cited by K. Banerjee), 594.
 Rammstedt (cited by R. R. MacGregor), 999.
 Rand, Carl W., 424.
 Ranke (cited by K. Fischel), 1030.
 Rankin, Fred W., 806, 998.
 Raper (cited by S. Parenti), 993.
 Rask-Nielsen, H. C., 564, 565.
 Räth, 794.
 Ratkóczy, Nándor, 102.
 Ratschow, Max, 609.
 Ratti, Arduino, 414, 422.
 Raul, P., 928.
 Ravdin, I. S., 507.
 Rave, Franz, 52, 57.
 Ray, B. B., 595.
 Razemon, P., 480, 482.
 Read, J. Sturdivant, 107.
 Reboul (cited by W. W. Belden), 924.
 Rechou, —, 960.
 von Recklinghausen, Friedrich D., 83, 180, 657, 986.
 von Recklinghausen's disease, 176-178.
 Rectum, cancer of, Factors influencing treatment of, G. E. Binkley (abstract), 588.
 Rectum, carcinoma of, Skeletal metastases from: report of eight cases, A. H. Aufses (abstract), 986.
 Redecker (cited by H. Steininger), 823.
 Reerink, E. H., 547.
 Regaud, Cl., 85, 299, 300, 437, 443, 535, 591, 832, 887, 890, 960, 988.
 Regelsberger, H., 95, 399, 405.
 Reiche, F., 164, 179.
 Reichel, Paul, 270.
 Reimann, Stanley P., 660, 663.
 Reinecke, Harold G., 990.
 Reinhard, Melvin C., 575.
 Reisner, Alfred, 12, 315, 406, 420, 611.
 Remer, John, 394.
 Renal bleeding, unilateral, Unusual case of, E. Smith (abstract), 1006.
 Renal calculi, diagnosis and treatment of, Observations on, G. S. Foulds (abstract), 1003.
 Renal calculi in children, Bone suppuration and, M. C. Borman (abstract), 793.
 Renal carbuncle, T. D. Moore (abstract), 1005.
 Renal cysts, Solitary serous, with study of roentgen observations, R. Herbst and W. J. Vynalek (abstract), 1008.
 Renal denervation, Studies in. I.—Roentgenograph-ic demonstration of vascular alteration, G. Milles, E. F. Müller, and W. F. Petersen (abstract), 1004.
 Renal lithiasis, Value of uroselectan in, W. F. Braasch (abstract), 1004.
 Renal rotation and associated anomalies, Anomalous, W. F. Braasch (abstract), 795.
 Renal tuberculosis, Intravenous urography in diagnosis of: Case report, T. Sweetser (abstract), 1006.
 Respiratory system, diseases of, Use of ultra-violet light (Osram-Vitalux-Lamp) in, A. Moeller (abstract), 834.
 Respiratory tract, upper, Roentgenology of, H. K. Pancoast (abstract), 600.
 Reyn, Axel, 738, 743.
 Reynolds, Charles R., 391.
 Reynolds (cited by J. D. Garvin), 825.
 Rheumatism or arthritis, chronic, Orthopedic aspects of, R. B. Osgood (abstract), 975.
 Rhinology, Roentgen therapy in, 419.
 Rhyne, S. A., 928.
 Ricca, Silvio, 928.
 Rice, E. Clarence, 179.
 Rich, Edward A., 928.
 Richards, G. E., 51.
 Richardson, O. W., 76.
 Richmond, D. S., 335, 338.
 Richtmyer, F. K., 304, 306, 308, 314.
 Rickets, 166, 168.
 Rickets, fetal, Osteomalacia and, J. P. Maxwell (abstract), 410.
 Rickets, Healing of late, coincident with low serum phosphate, G. Stearns and J. D. Boyd (abstract), 1016.
 Rickets, phosphorus in, Effect of: I.—Roentgenologic changes in rickets following administration of phosphorus, E. L. Compere (abstract), 1016.
 [Rickets] Rachitic children, Chest in: roentgenologic study, R. S. Bromer (abstract), 989.
 Riddle, Penn, 582.
 Rideal, E. K., 327.
 "Riders' bone," 144, 193.
 Riebel, Frank A., joint-author, 380.
 Riebel, J. A., and Riebel, Frank A., Fatal result from use of uroselectan, 380.
 Riedel (cited by A. Steindler), 983.
 Rieder, H., 329, 333.
 von Ries (cited by E. Conte), 837.
 Riggs, Charles E., 391.
 Rigler, Leo G., 73, 604, 998.
 Ringworm of hands and feet, W. A. Osborne (abstract), 420.
 Rioux, G., 928.
 Rischin, M., 331, 333.
 Rishmiller, John H., 928.
 Rist, E., 26, 28.
 Ritchie (cited by F. D. Ackman), 103.
 Ritchie, Gorton, joint-author, 445, 945.
 Ritvo, M., 253, 270.
 Ritzman (cited by Harvey Smith), 695.
 Riven, Samuel S., 1010.
 Robertson, J. D., 938, 940.
 Robertson, J. K., 704.
 Robertson, William E., 480, 482.
 Robineau (cited by W. W. Belden), 928.
 Robinson, H. R., 779.
 Robinson (cited), 595, 1029.
 Rocher, H. L., 928.
 Rochetaux, J., 928.
 Roederer, Carle, 927.
 Roentgen amenorrhea, temporary, Clinic of, C. J. Gauss (abstract), 110.
 Roentgen and radium injuries, Promising ways to

- cure of hopeless, K. Graninger (abstract), 941.
- Roentgen and radium therapy in advanced cancer, with various combinations of wave lengths, Clinical evaluation of, B. P. Widmann and J. L. Weatherwax (abstract), 585.
- Roentgen and radium therapy, Relative value, R. H. Crockett (abstract), 812.
- Roentgen and radium treatment, Nitrogen excretion in urine following, G. K. F. Schultze (abstract), 420.
- Roentgen and radium treatment, Systemic changes in patients with carcinoma of uterus, following, E. O. Gaessler (abstract), 89.
- Roentgen and ultra-violet rays, Action of, on reticulohistiocytic system of skin, P. G. Castellino (abstract), 817.
- Roentgen appearance of chest in new-born infant, J. T. Farrell, Jr. (abstract), 94.
- Roentgen aspects: Hypertrophic pyloric stenosis in adults, V. W. Archer (abstract), 99.
- Roentgen deep therapy, Simple field selector in, G. H. Schneider (abstract), 811.
- Roentgen diagnosis and treatment of enlargement of thymus, E. P. Pendergrass (abstract), 821.
- Roentgen diagnosis in obstetrics, Results and value of, K. Heim (abstract), 1009.
- Roentgen diagnosis of ascariasis, V. W. Archer and C. H. Peterson (abstract), 623.
- Roentgen diagnosis of chronic appendicitis, H. J. Walton and S. Weinstein (abstract), 572.
- Roentgen diagnosis of gastric syphilis, L. T. LeWald (abstract), 788.
- Roentgen diagnosis of inflammatory lesions of colon and their differentiation from carcinomas, H. Pansdorf (abstract), 100.
- Roentgen diagnosis of pulmonary tuberculosis, Early, L. J. Menville (abstract), 825.
- Roentgen diagnosis of pulmonary tuberculosis in infants and children, R. G. Karshner (abstract), 433.
- Roentgen diagnosis of rickets, R. S. Bromer (abstract), 409.
- Roentgen diagnosis of synovial adhesions (abstract), 608.
- Roentgen dosage in practice, T. C. Neef (abstract), 785.
- Roentgen dosage in skin disease, Need of more conservative, W. F. Spiller (abstract), 817.
- Roentgen dose unit, Reproductivity of, H. Behnken and R. Jaeger (abstract), 611.
- Roentgen examination of female urethra, specially in cases of prolapse and incontinence, E. Thomsen (abstract), 798.
- Roentgen injuries, Experimental, of heart muscle, A. Werthemann (abstract), 994.
- Roentgen therapy, Evaluation of modern, R. E. Loucks and B. R. Dickson (abstract), 1021.
- Roentgen evidence of adhesions of small intestine, H. W. Soper and J. W. Thompson (abstract), 102.
- Roentgen examination in diseases of trachea, Max Sgalitzer (abstract), 428.
- Roentgen examination in technical fields, Kantner and A. Herr (abstract), 58.
- Roentgen examination of paranasal sinuses and mastoids, A. Granger (abstract), 814.
- Roentgen examination of sacro-iliac joint, Symphyphysis pubis in, W. E. Chamberlain (abstract), 575.
- Roentgen examination of stomach and small bowel, Appraisal of motor-test-meal in, A. B. Moore (abstract), 97.
- Roentgen exposure, Changes in lungs following, M. Ludin and A. Werthemann (abstract), 990.
- Roentgen irradiation, Hodgkin's disease, with special reference to diagnostic difficulties and results following: Report of case, G. A. Sherman (abstract), 1012.
- Roentgen irradiation with old treatment technic and ray-proof Metalix tubes, Comparative studies of blood injuries following, W. Fürst (abstract), 575.
- Roentgen observations, Solitary serous renal cysts with study of, R. Herbst and W. J. Vynalek (abstract), 1008.
- Roentgen radiation (200 K.V.), Effect of high voltage, upon fertility and motility of sperm of rabbit, S. A. Asdell and S. L. Warren (abstract), 814.
- Roentgen rays and gamma rays of radium, biologic effect of, Comparison of, R. Braun (abstract), 411.
- Roentgen rays, biologic effect of: increase of roentgen-ray effect by secondary radiation (fourth communication), P. Ellinger and E. Gruhn (abstract), 410.
- Roentgen rays, Biologic unit in dosage of, E. Björling (abstract), 784.
- Roentgen rays, Blood sugar regulation under influence of, A. Held (abstract), 411.
- Roentgen rays, boils and carbuncles, Treatment of, by, E. T. Leddy and S. A. Morton (abstract), 411.
- Roentgen rays, Color changes produced by, in some aqueous solutions: considered for dosage measurements and for detection of effects of radiation on other chemical compounds, W. Stenstrom and A. Lohmann, 322.
- Roentgen ray, diagnostic value of, in peptic ulcer before and after treatment, E. S. Emery, Jr., and R. T. Monroe (abstract), 787.
- Roentgen-ray diagnosis of urologic conditions, H. K. Wade and H. C. Chenault (abstract), 793.
- Roentgen rays, endometriosis rectovaginalis treated successfully by, Case of, J. Heyman (abstract), 416.
- [Roentgen ray] Fractional dose method with varying intervals, Studies of changes of skin tolerance using, A. Reiser (abstract), 420.
- Roentgen rays, Giant-cell tumors: four cases successfully treated by, L. T. LeWald (abstract), 84.
- Roentgen rays, graded doses of, Effect of, on mitosis in *Vicia faba equina*, O. Jüngling and H. Langendorff (abstract), 610.
- Roentgen ray in obstetric diagnosis, as an adjunct, H. B. Matthews (abstract), 799.
- Roentgen rays, injuries due to, late, Animal experimental foundations of problem of, L. Nürnberg (abstract), 405.
- Roentgen-ray intensity, Question of distribution of, in human body in deep therapy. I.—Critical review of problem and its principles, M. Dorneich (abstract), 811.
- Roentgen rays on bone marrow, Experimental studies concerning effect of (II), A. Casati (abstract), 994.
- Roentgen rays on eye, Effect of, W. Rohrschneider (abstract), 813.
- Roentgen rays on healing of wounds, Influence of, S. Fukase (abstract), 840.
- Roentgen rays on healing of wounds, Studies of effect of. I. Behavior of skin wounds in rats under pre- or post-operative irradiation, E. A. Pohle, Gorton Ritchie, and C. S. Wright, 445.
- Roentgen rays, sensitizing effect of hematoporphyrins to, N. A. Podkaminsky (abstract), 413.
- Roentgen rays, similar effect of ultra-violet and of, Case of, K. Brummer (abstract), 835.

- Roentgen rays, soft, Application of and indications for, A. Böhm (abstract), 1021.
- Roentgen rays, Sterilization of women by, G. Fritsch (abstract), 799.
- [Roentgen ray] Superficial therapy apparatus with constant output, W. H. Boldingh (abstract), 571.
- Roentgen rays, Testicular seminomas and their treatment by means of, J. B. Porchovnik and G. N. Treister (abstract), 415.
- Roentgen-ray therapy, deep, of mammary carcinoma. II.—Five-year results: Value of the method as an auxiliary to surgical procedures in the operable and as a primary procedure in the inoperable cases, W. A. Evans and T. Leucutia (abstract), 812.
- Roentgen-ray therapy, Spinal, in dermatitis herpetiformis, H. R. Foerster (abstract), 410.
- Roentgen rays, Treatment of diseases of tonsils with, J. Grünthal (abstract), 1020.
- Roentgen-ray tubes, with complete high tension protection up to 200 K.V., A. Bouwers (abstract), 571.
- Roentgen rays, Xanthomatosis (Schüller's disease; Christian's syndrome): report of three cases treated with, M. C. Sosman (abstract), 414.
- Roentgen sickness, Relation between cholesterol metabolism and, R. Hummel (abstract), 806.
- Roentgen stereoscopy of kidney, Demonstration of kidneys with abrodil and some remarks about, W. Teschendorf (abstract), 792.
- Roentgen symptoms of post-appendicitis abscesses, R. Pohl (abstract), 573.
- Roentgen therapy, deep, of tuberculosis of lungs, Present status and importance of, H. Schulte-Tiggens (abstract), 826.
- Roentgen therapy, gynecological, Development of, during past ten years in Second University Clinic for Women at Budapest, F. Gál (abstract), 400.
- Roentgen therapy in dermatology, IX (Principles of roentgenotherapy), E. A. Pohle (abstract), 419.
- Roentgen therapy in gynecology, VIII (Principles of roentgenotherapy), E. A. Pohle (abstract), 418.
- Roentgen therapy in pediatrics, ophthalmology, otology, rhinology, laryngology, neurology, and psychiatry, X (Principles of roentgenotherapy), E. A. Pohle (abstract), 419.
- Roentgen therapy of spine in skin diseases, A. Krynski (abstract), 811.
- Roentgen therapy in tuberculosis of adnexa, Further experience with, H. Eymer (abstract), 417.
- Roentgen therapy of agranulocytosis, F. Burgheim (abstract), 417.
- Roentgen therapy of subacute and chronic pelvic inflammatory diseases, L. Seitz (abstract), 416.
- Roentgen therapy of tabes, C. Kremser (abstract), 814.
- [Roentgen therapy] Principles of "long weak" treatment method, G. Schwarz (abstract), 413.
- Roentgen therapy, Uterine sarcoma and, A. Béclère (abstract), 417.
- Roentgen treatment of brain tumor, Further experience with, K. Bachmund (abstract), 414.
- Roentgen treatment of Coutard, Our experience with protracted fractional, A. Kahlstorf and A. Zupfinger (abstract), 812.
- Roentgen treatment of hyperthyroidism, W. Clarkson (abstract), 813.
- Roentgen treatment of lymphogranulomatosis, H. U. Billich (abstract), 416.
- Roentgen treatment of metastasis to vertebræ and bones of pelvis from carcinoma of breast, E. T. Leddy (abstract), 811.
- Roentgen treatment of para-urethral infiltrates, Contribution to, S. Grauer (abstract), 418.
- Roentgen treatment of toxic goiter, E. Hayer and W. Hufschmid (abstract), 431.
- Roentgen treatment of tuberculosis of male genital organs, Contribution to, J. Grünthal (abstract), 1017.
- Roentgen treatment, Studies of skin tolerance with protracted, A. Kahlstorf (abstract), 1017.
- Roentgenogram of spondylitis typhosa, J. Arendt (abstract), 821.
- Roentgenograms, sinus, Interpretation of, G. W. Grier (abstract), 815.
- Roentgenographic contrast diagnosis in obstetrics and gynecology, Newer methods of, J. Jarcho (abstract), 801.
- Roentgenographic demonstration of vascular alteration (I). Studies in renal denervation, G. Milles, E. F. Muller, and W. F. Petersen (abstract), 1004.
- Roentgenographic studies in normal osseous development, E. K. Shelton (abstract), 979.
- Roentgenographic study of renal vessels, New technique for, G. Milles, E. F. Müller, and W. F. Petersen (abstract), 1002.
- Roentgenographic visualization of body cavities, Campidol (iodized rapeseed oil): use in, M. A. Glaser (abstract), 992.
- Roentgenography, Minimum requirements for, H. J. Ullmann (abstract), 1019.
- Roentgenography of abdominal viscera, Year's progress in (abstract), 972.
- Roentgenologic appearance of diverticula of duodenum and of structures resembling such diverticuloids, R. Sander (abstract), 102.
- Roentgenologic appearance of lobular pneumonia (bronchopneumonia), N. W. Potte (abstract), 94.
- Roentgenologic appearance of subphrenic abscess on post-appendiceal basis, O. Meller (abstract), 620.
- Roentgenologic appearance of thrombosis of left auricular appendage, J. Arendt (abstract), 403.
- Roentgenologic changes in rickets following administration of phosphorus (I.): Effect of phosphorus in rickets, E. L. Compere (abstract), 1016.
- Roentgenologic changes in sarcoid and related lesions, B. R. Kirklin and S. A. Morton, 328.
- Roentgenologic demonstration of gastric myoma, H. Gebhardt (abstract), 617.
- Roentgenologic demonstration of kidneys and urinary passages by intravenous injection of uroselectan, Concerning, K. Hutter and M. Sgalitzer (abstract), 106.
- Roentgenologic demonstration of mucosa by means of umbrathor: contribution to roentgenologic diagnosis of ulcerative colitis, H. Regelsberger (abstract), 95.
- Roentgenologic demonstration of spleen and liver, Clinical use of "lienography," new method for, M. Oka (abstract), 95.
- Roentgenologic demonstration of urinary tract, Technic of, J. Becker (abstract), 1003.
- Roentgenologic diagnosis in tuberculosis of kidney, B. H. Nichols (abstract), 794.
- Roentgenologic diagnosis of bone tumors, C. F. Geschickter, 111-180.
- Roentgenologic diagnosis of chronic obstruction of small intestines, Contribution to, G. Lemmel (abstract), 623.
- Roentgenologic diagnosis of coarctation of aorta (adult type), W. W. Fray (abstract), 403.

- Roentgenologic diagnosis of tuberculosis of supraprenals, R. Schatzki (abstract), 825.
- Roentgenologic diagnosis of ulcerative colitis, Contribution to, H. J. Teschendorf (abstract), 622.
- Roentgenologic examination in pulmonary tuberculosis, Value of, H. L. Sampson and L. Brown (abstract), 1030.
- Roentgenologic examination, Lobus venae azygos: visibility on, and significance for clinician, G. Velde (abstract), 93.
- Roentgenologic examination, Lower esophagus and upper portions of stomach as seen by, J. Palugay (abstract), 996.
- Roentgenologic examination of colon, H. H. Berg (abstract), 999.
- Roentgenologic findings in a series of seventy-two cases of traumatic myelitis due to fracture of spine, E. S. Gurdjian (abstract), 819.
- Roentgenologic observations of appendix, W. Knothe (abstract), 572.
- Roentgenologic pressure signs, Intracranial pressure: correlation of choked disc and, F. Schreiber (abstract), 424.
- Roentgenologic significance, Intracranial calcification and its, J. D. Camp (abstract), 422.
- Roentgenologic study of breast, S. L. Warren, 696.
- Roentgenologic studies of urinary tract with contrast agents administered intravenously: Diagnosis in urology, R. E. Cumming (abstract), 1007.
- Roentgenological appearance of interlobar and mediastinal encapsulated effusion in thorax, Eugene Freedman, 14-29.
- Roentgenological aspect of various types of colonic diverticula, W. O. Upson and A. E. MacGregor, 30-37.
- Roentgenological control of exposed kidneys in operations for nephrolithiasis, with use of special intensifying cassette, E. Beer (abstract), 1007.
- Roentgenological diagnosis of diaphragmatic hernia, Progress in, A. B. Moore and B. R. Kirklin (abstract), 609.
- Roentgenological differentiation of benign and malignant diseases of bones, R. Kienböck (abstract), 577.
- Roentgenological standpoint, Pathological thymus in children from a, W. H. Gilmore (abstract), 1027.
- Roentgenological study of superior and posterior mediastinum, S. Brown and H. G. Reinecke (abstract), 990.
- Roentgenology and internship (editorial), Irvin D. Metzger, 68-70.
- Roentgenology, Elimination of dark room in photography, especially as applied to, H. Flecker, 381.
- Roentgenology of appendix, J. W. Larimore (abstract), 974.
- Roentgenology of thymus in infancy and differential diagnoses of enlarged thymus and its treatment, H. K. Pancoast (abstract), 821.
- Roentgenology of upper respiratory tract, H. K. Pancoast (abstract), 600.
- Roentgenotherapy in carcinomatous metastasis of bone, Value of, A. Ratti (abstract), 414.
- Roentgenotherapy of bronchial asthma, G. M. Sack (abstract), 414.
- Roentgenotherapy of surgical tuberculous diseases, Results of, J. Palugay (abstract), 1022.
- Rohrhirsch, Otto, 1026.
- Rohrschneider, W., 813.
- Rokitansky (cited by W. W. Belden), 916.
- Rollet (cited by W. W. Belden), 927.
- Rollier, Auguste, 741, 743, 826, 1015.
- Rolnick, H. C., 933, 935.
- Romanoff, A., 1010.
- Roosen (cited by H. Hirsch), 415.
- Roosen-Bernhardt (cited by H. Cramer), 412.
- Rorem, C. Rufus, 388.
- Rosbaud, P., 779.
- Rose, Cassie B., X-ray treatment of bone metastasis, 536.
- Rosenthal, transglottic method of, for injection of iodized oil, 95.
- Rother, Franz, 780.
- Rothmann, Hans, 822.
- de Rothschild, H., 960.
- Rothstein, Karl, 327.
- Rotolo, Giuseppe, 576.
- Rottenstein, G., 928.
- Rottmann, H. G., 704.
- Roudil, G., 928.
- Rubascheva, Anastasia, 97.
- Rubin, Eli H., 434.
- Ruckensteiner, E., 967.
- de Rudder, Bernhard, 941.
- Rudisill, Hillyer, Jr., 786, 815, 942, 989.
- Rudisill, Hillyer, Jr., X-ray visualization of calcified gallstone in child seven years old: case report, 942. See other references.
- Rudolph, Louis, 335, 338.
- Ruete (cited by F. C. Wood and G. M. MacKee), 704.
- Rugh, J. Torrance, 928.
- Ruggles, Howard E., 59.
- Rumford, S. C., 75.
- Rump, W., 310.
- Rush Medical College, Chicago, Surgical Department, 972.
- Russell, Albert E., 605.
- Russell, A. S., 468, 471.
- Russell, W. Kerr, 836.
- Rutherford, E., 467, 508, 525.
- Ryerson, E. W., 209, 210.
- Sabouraud-Noiré tablet, dosimetry with, Contribution to, K. Hoede (abstract), 611.
- Sabouraud, R., 90, 322, 327.
- Sachs, G., 781, 783.
- Sack, G. M., 414.
- Sacro-iliac joint, roentgen examination of, Symphysis pubis in, W. E. Chamberlain (abstract), 575.
- Sagel, Jacob, 564, 604.
- Saidman, Jean, 704.
- "Sailor's skin," 436.
- Saint, James H., 270.
- Sainton, Paul, 928.
- Saito, Makoto, 608.
- Salinger, H., 682.
- Salotti, Adelchi, 86.
- Salpingography, hydrops tubae profluens by, Diagnosis and therapy of case of, O. Polano (abstract), 400.
- Sampson, Homer L., 1030.
- Sampson (cited by C. E. Weaver), 64.
- Sandera, Robert, 102.
- Sandstrom (cited by J. de J. Pemberton and K. B. Geddie), 431.
- Sanford, Heyworth N., 739, 743.
- Sansum (cited by M. J. Geyman), 483.
- Sante, L. R., 28.
- Santoro, Mario, 819.
- Sarazin, A. C. L., 928.
- Sarcoid and related lesions, Roentgenologic changes in, B. R. Kirklin and S. A. Archibald, 328.
- Sarcoma, 183, 214, 251; chondroblastic, 135, 137, 138; Ewing's, 123-129, 150, 183-185, 197, 229, 233, 234, 240-244, 251, 252, 556, 627-656; osteogenic, 118-124, 131-137, 141, 143; sclerosing, 251.

- Sarcoma, Ewing's, Endothelial myeloma or, W. B. Coley, 627.
- Sarcoma, Ewing's, Report of patient with, E. E. Larson, 556.
- Sarcoma, giant-cell, of vertebrae, Management of: report of case with cure after five years, J. O. Bower, J. H. Clark, and L. Davis (abstract), 833.
- Sarcoma of gall bladder, Primary, A. Brunschwig (abstract), 995.
- Sarcoma of skin and fascia, Relation between histologic structure and prognosis in, L. C. Pusch, 660.
- Sarcoma of stomach: Report of four cases and review of literature, R. D'Aunoy and A. Zoeller (abstract), 830.
- Sarcoma of uterus treated by irradiation, Few cases of, C. Regaud and A. Lacassagne (abstract), 832.
- Sarcoma of vertebra, Primary, O. Rohrhirsch (abstract), 1026.
- Sarcoma, osteogenic, Report of two cases, possibly traumatic in origin, Byron H. Jackson, 766.
- Sarcoma, radiotherapy in, Indications for, A. Lacassagne (abstract), 985.
- Sarcoma, Uterine, and roentgen therapy, A. Bécélère (abstract), 417.
- Sargent, James C., 933, 935.
- Saskatchewan Public Health Department, 47, 49.
- Satta, F., 928.
- Saturation method, 420, 967, 988.
- Saturation method? Maximum dose, fractional treatment, or (studies on mice with carcinoma), J. Juul (abstract), 784.
- Saturation method of Pfahler and Kingery (III): Present methods of radiation treatment of carcinoma and results, H. Holfelder (abstract), 589.
- Sauter (cited), 868.
- Saville (cited by A. Müller), 596.
- Savy, Paul, 25, 28.
- Sawyer, Ralph A., 736, 743.
- Schaedel, Wilhelm, 58.
- Schaefer, H. E., 50, 845.
- Schaefer, W., 973.
- Schaefer (cited by E. Zweifel), 585.
- Schall, L., 600.
- Schall (cited by A. Reisner), 420.
- Schapiro, Herman, 116.
- Schatzki, R., 825.
- Schauffler, Robert McE., 820.
- Schauffler, W. G., 627.
- Schaumann, Jörgen, 328, 333.
- Schechter, Samuel, 101.
- Scheidel, William, 964.
- Scheigert, F. W., 75.
- Schenck (cited by U. Hofmann and E. Groll), 598.
- Scherb, R., 928.
- Schereschewsky, J. W., 707, 708, 709, 718.
- Schiessel, Max, 928.
- Schiff (cited by M. A. Blankenhorn), 805.
- Schinz, Emmy, 928.
- Schinz, H. R., 331, 333.
- Schipporeit, G., 928.
- Schlecht, H., 1029.
- Schlechtmann, J., 3.
- Schliephake, Erwin, 973.
- Schlieppe (cited by J. S. Coulter and E. M. Smith, Jr.), 739.
- Schlitz (cited by R. H. Jamieson and F. Hernaman-Johnson), 810.
- Schlundt, Herman, 807.
- Schmid, E., 593.
- Schmidt-Labaume, F., 421.
- Schmitz, Franz, 788.
- Schmitz, Henry, 376, 379, 459.
- Schmorl (cited), 426, 1025.
- Schneider, Chester C., 820.
- Schneider, Georg Heinrich, 811.
- Scholtz, Moses, 421.
- Scholtz (cited by F. C. Wood and G. M. MacKee), 704.
- Schönfeld (cited by L. Schall and F. Hoffmann), 600.
- Schons, Edward, 73.
- Schreiber, Frederic, 424.
- Schreus, H., 571, 704.
- Schroeder, William E., 82.
- Schrotter (cited by R. T. Shackelford), 1011.
- Schueller, J., 792.
- Schüller, M. P., 928.
- Schüller's disease; Christian's syndrome (Xanthomatosis): report of three cases treated with roentgen rays, M. C. Sosman (abstract), 414.
- Schulte-Tigges, H., 826.
- Schultz, Frank, 704.
- Schultze, Günter K. F., 420.
- Schultze, Walter, 994.
- Schulz, Alfred, 928.
- Schulze, M. H., 404.
- Schürch, O., 457, 459.
- Schwarz, G., 413.
- Schwarzschild, M. M., Theory of X-ray quality measurement, 856.
- Schweidler (cited by C. S. Barrett, R. A. Gezelius, and R. F. Mehl), 463, 467; (by R. F. Mehl, G. E. Doan, and C. S. Barrett), 512, 517.
- Sciaky, Enrico, 928.
- Scougall, S. H., 928.
- Screens, intensifying, in relation to quality of radiations in radiologic technic, Effect of, V. Podestà (abstract), 571.
- Scudder (cited by J. R. Moore), 233.
- Scurvy, 163, 165.
- Sear, H. R., 1009.
- Seasonal diseases, Problem of, B. de Rudder (abstract), 941.
- Seemann, H., 780.
- Seidler, Ferdinand, 980.
- Seitz, L., 416, 585.
- Seitz (cited by F. Melchart), 1021.
- Selinger, Maurice A., 179.
- Seminomas, Testicular, and their treatment by means of roentgen rays, J. B. Porchovnik and G. N. Treister (abstract), 415.
- Semken, George H., 689, 693.
- Senger, Fedor L., 107.
- Sereghy, Michael, 928.
- Sergent, E., 29.
- Sewall (cited by L. E. Patrick), 815.
- Sexton (cited by H. C. Bumpus, Jr.), 790.
- Sezai (cited by W. W. Belden), 928.
- Sgalitzer, Max, 77, 106, 428.
- Shackelford, Richard T., 1011.
- Shangle, Milton A., 480, 482.
- Shannon, E. H., 429.
- Shapiro, M. J., 564.
- Sharp, George S., 581.
- Shaw, W. McL., 485.
- Shearer (cited by R. D. Spangler), 360.
- Sheehan, William C., 646.
- Sheldon, Francis B., joint-author, 952.
- Sheldon, Francis B., 83, 90, 91, 106, 413, 421, 433, 616, 787, 795, 831, 952, 978, 985, 1019.
- Shelmire (cited by I. M. Martin), 887.
- Shelton, E. Kost, 979.
- Shepley, E. E., 563.
- Sherman, George A., 1012.
- Sherwell method, 442.

- Shore, Benjamin Rice, 480, 482, 614.
 Shore, L. R., 928.
 Sicard (cited by W. W. Belden), 928.
 Siciliano, L., 395.
 Sidlick, D. M., 328, 330, 332.
 Sighinolfi, Giuseppe, 103.
 Sigmoidoscopy *versus* X-rays in diagnosis of terminal bowel disease, F. C. Yeomans (abstract), 622.
 Silbar, Sidney J., 793.
 Silicosis, T. H. Belt (abstract), 604.
 Silver, David, 179.
 Silvero, J. E. Lopez, 773.
 Simmons, Channing C., 244, 881, 890.
 Simon, H. E., 133, 179.
 Simonds, J. P., 719.
 Simons, Alb., 457, 459.
 Simpson, Frank E., 891.
 Simpson (cited by S. Forsdike), 800.
 Simson, J., 975.
 Singer, G., 6, 10-12, 309, 321, 894.
 Singer, Siegmund, 29.
 Sinus conditions, nasal, Use of iodized oil in diagnosis of: Further observations, H. M. Good-year (abstract), 1023.
 Sinus disease, chronic, Management of, W. V. Mullin (abstract), 1023.
 Sinus disease, Relation of, to pulmonary infection, from standpoint of roentgenologist, W. F. Manges (abstract), 1022.
 Sinuses, nasal accessory, roentgenography of, Head clamps for fenestrated shield for, Mrs. J. D. Blocher, 554.
 Sinus, Osteoma of frontal, R. O. Leavenworth (abstract), 815.
 Sinuses, paranasal, Roentgen examination of, and mastoids, A. Granger (abstract), 814.
 Sinus roentgenograms, Interpretation of, G. W. Grier (abstract), 815.
 Siperstein, David M., 1000.
 Sippy (cited by R. C. Brown), 625, 626.
 Sise, L. F., 495, 502, 507.
 Sistrunk, W. E., 881, 890.
 Skála-Rosenbaum, Jan, 928.
 Skemp, A. A., 944.
 Skin, Action of roentgen and ultra-violet rays on reticulohistiocytic system of, P. G. Castellino (abstract), 817.
 Skin and fascia, sarcoma of, Relation between histologic structure and prognosis in, L. C. Pusch, 660.
 Skin, basal-cell epithelioma of, Electrodesiccation *versus* radiotherapy in treatment of, G. Archambault and A. Marin (abstract), 422.
 Skin, Biological investigations concerning effect of graded doses of radium on, A. Reisner (abstract), 406.
 Skin, carcinoma of, Cosmetic results of electrocoagulation and radium treatment, especially of, A. Buschke and L. Loewenstein (abstract), 807.
 Skin diseases about eyes, R. Fields (abstract), 420.
 Skin disease, Need of more conservative roentgen dosage in, W. F. Spiller (abstract), 817.
 Skin diseases, Roentgen therapy of spine in, A. Krynski (abstract), 811.
 Skin, Grenz rays upon, Effect of, K. Herxheimer and E. Uhlmann (abstract), 797.
 Skin, human, Polarization measurements on: contribution to Basedow's disease and its radiotherapeutic estimation, H. Regelsberger (abstract), 399.
 Skin, lip, and tongue, Cancer of: Ministry of Health report, J. Lane-Claypon (abstract), 987.
 Skin malignancy: comments on therapy, R. H. Stevens, 435.
 Skin, pigmentation in, Influence of air pressure on formation of erythema and, F. Schmidt-Laubaume and E. Uhlmann (abstract), 421.
 Skin, radiation injuries to, Possibility of preventing, E. Uhlmann (abstract), 422.
 Skin, Temperature measurements in, and relation to degree of cooling, W. Schultze (abstract), 994.
 Skin tolerance, Studies of, with protracted roentgen treatment, A. Kahlstorf (abstract), 1017.
 Skin tolerance using fractional dose method with varying intervals, changes of, Studies of, A. Reisner (abstract), 420.
 Skin wounds in rats under pre- and post-operative irradiation, Behavior of (Studies of effect of roentgen rays on healing of wounds), E. A. Pohle, Gordon Ritchie, and C. S. Wright, 445.
 Skinner, E. H., 928.
 Sklarz, Ernst, 703.
 Skobelzyn, D., 509, 512, 513.
 Skoda (cited by R. T. Shackelford), 1011.
 Skull, Angioma racemosum in, L. Frigýér (abstract), 423.
 [Skull] Congenital cerebral cysts of *cavum septi pellucidi* (fifth ventricle) and *cavum vergae* (sixth ventricle): Diagnosis and treatment, W. E. Dandy (abstract), 819.
 [Skull] Cranial radiography, E. Dufresne (abstract), 1025.
 Skull examinations, survey of 3,000 consecutive: Indirect signs of brain tumor as noted in routine roentgen examinations: displacement of pineal shadow, C. G. Dyke (abstract), 424.
 [Skull] Hyperfunction of hypophysis in childhood: New syndrome, C. I. Parhon and C. Parhon-Stéfanescu (abstract), 1024.
 [Skull] Hypophyseal lacunar dysostosis, M. Santoro (abstract), 819.
 [Skull] Pituitary body, Radiological diagnosis and radiation therapy of tumors of, Q. Vischia (abstract), 829.
 Sluys, Felix, 96.
 Slye, Maud, 436, 444.
 Smiley, D. F., 740, 743.
 Smirnow, A. W., 928.
 Smith, Clayton S., 992.
 Smith, Edwin M., Jr., joint-author, 737.
 Smith, Emerson, 1006.
 Smith, Harvey, Paget's disease of bone, 694.
 Smith, Hugh, 612.
 Smith, J. S. Kellett, 928.
 Smith, N. R., 237, 244.
 Smith, O. A., 237, 244.
 Smith, W. Atmar, 94.
 Smith, William H., 604.
 Smithies, Frank, 621, 962.
 Smoler, Felix, 270.
 Sneller, Charles D., 988.
 Snoke, P. O., 819.
 Snow, C., 6, 894.
 Snyder, A. E., 74.
 Soddy, F., 468, 471.
 Soiland, Albert, 90, 91, 587.
 Sokoloff, Boris, joint-author, 746.
 Sokoloff (cited by A. Steindler), 983.
 Solcard, M., 927.
 Solcard (cited by W. W. Belden), 924.
 Solomon, I., 2.
 Sommerfeld, A., 511.
 Sonne, Carl, 732, 736.
 Soper, Horace W., 102, 253, 264, 270.
 Soresi, A. L., New diaphragm for complete elimination of secondary radiation, 486.

- Sorrell-Dejerine, Mme., 928.
 Sorrel, Etienne, 928.
 Sosman, Merrill C., 414, 553.
 South, symptom complex frequently seen in, 100.
 Spaeth (cited by W. W. Belden), 916.
 Spangler, D., 335, 338.
 Spangler, Ross D., Comparison of X-ray diffraction intensities with structure factor computations in liquid long chain compounds, 359.
 Spector, H. I., 606.
 Speed, Kellogg, 929.
 Spiethoff, B., 704.
 Spiller, W. F., 817.
 [Spine] Back strain, Analysis of 100 consecutive cases of, M. O. Henry (abstract), 427.
 Spine, cervical, child's in roentgenogram, Hypertorsion of, E. Kehrer (abstract), 426.
 [Spine] Disabling back pain: Differential diagnosis and treatment, R. McE. Schaeffler (abstract), 820.
 Spine, fracture of, Double isolated compression, C. C. Schneider (abstract), 820.
 Spine, fracture of, Roentgenologic findings in series of seventy-two cases of traumatic myelitis due to, E. S. Gurdjian (abstract), 819.
 Spine, hypertrophic osteo-arthritis of, Differential diagnosis of pain of angina pectoris and radicular syndrome of, D. C. Sutton (abstract), 426.
 [Spine] Intervertebral nucleus pulposus: Its anatomy, its physiology, its pathology, J. Calvé and M. Galland (abstract), 1025.
 [Spine] Low-back injuries, X-ray observations in, J. C. Johnston (abstract), 426.
 [Spine] Myelomatosis in child of 8 years, P. Jacoby (abstract), 427.
 [Spine] Roentgenogram of spondylitis typhosa, J. Arendt (abstract), 821.
 Spine, Roentgen therapy of, in skin diseases, A. Krynski (abstract), 811.
 [Spine] Spinal cord, Diagnosis of tumors involving, H. W. Woltman (abstract), 827.
 [Spine] Vertebra, Fifth lumbar, roentgenologically demonstrated, W. W. Belden, 905.
 [Spine] Vertebra, Primary, sarcoma of, O. Rohrhirsch (abstract), 1026.
 [Spine] Vertebra, sixth lumbar, Painful hemisacralization of, F. Talia (abstract), 1026.
 [Spine] Vertebral column, Lymphogranulomatosis of, W. Kuckuck (abstract), 1011.
 Spinelli, A., 577.
 Spitz (cited by W. W. Belden), 929.
 Spleen and liver, Clinical use of "lienography," new method for roentgenologic demonstration of, M. Oka (abstract), 95.
 Spleen, reticulo-endothelial system of, Effect of X-rays on, E. Conte (abstract), 416.
 Spondylitis, Tuberculous: Its clinical symptoms and curative results following sunlight and fresh air treatment, E. Kisch and H. Berger (abstract), 827.
 Spondylolisthesis, H. W. Meyerding (abstract), 820.
 Spriggs, E. I., 31-33, 37, 997.
 Sprue, 100.
 Staben, G. W., 929.
 Staemmler, Martin, 259, 270.
 Standardization, Committee on, Stockholm report of, 1.
 Standardization, X-ray, Recent progress in, L. S. Taylor, 1-13.
 Standards, Bureau of, 4, 302-321.
 Starr, Clarence L., 139, 179.
 Stearns, Genevieve, 1016.
 Steele, Paul B., 929.
 Stein, Jacob, 92.
 Steindler, Arthur, 983.
 Steininger, Hans, 923.
 Steinthal (cited by F. Melchart), 1021.
 Stemmler, W., 929.
 Stenstrom, K. W., 73, 322, 730.
 Stenstrom, K. W., Biophysical principles of physical therapy, 730.
 Stenstrom, Wilhelm and Lohmann, Anne, Color changes produced by roentgen rays in some aqueous solutions: considered for dosage measurements and for detection of effects of radiation on other chemical compounds, 322.
 Stephens, J. G., 571, 784, 807, 810, 1009.
 Stephenson, George W., 364.
 Sterilization of mother, temporary roentgen or radium, Development of children following, H. Naujoks (abstract), 405.
 Sterilization of women by roentgen rays, G. Fritsch (abstract), 799.
 Sterling, H. N., 13, 868.
 Stern, C., 704.
 Sternberg (cited by F. W. Stewart and C. A. Doan), 803.
 Stevens, Rollin H., 73, 376, 379, 435.
 Stevens, Rollin H., Skin malignancy: comments on therapy, 435.
 Stewart, A., 996.
 Stewart, Fred W., 591, 803.
 Stewart, George A., Report of five cases of subacute osteomyelitis of femur resembling sarcoma, 271.
 Stewart, G. W., 359.
 Stewart, M. J., 179.
 Stieve, H., 405.
 Stiles, James F., 74.
 Stockard, Charles R., 336, 339.
 Stoeckel (cited by E. Zweifel), 585.
 Stohr, Rudolf, 929.
 Stokes, William Royal, 604.
 Stoll, Henry F., 242.
 Stomach, Acute ulcerations of, in children, B. R. Shore (abstract), 614.
 Stomach, aleukemic leukemia of, and roentgenologic findings, Case of, V. Sváb (abstract), 997.
 Stomach and small bowel, roentgen examination of, Appraisal of motor-test-meal in, A. B. Moore (abstract), 97.
 Stomach, benign growths of, Diagnosis of nature of, A. Anzillotti (abstract), 100.
 Stomach, cancer of, Diagnosis and treatment of, P. Riddle (abstract), 582.
 Stomach, cancer of, Gastric retention, Great, and dilatation of stomach in cases of gastroduodenal ulcer and, T. Klason (abstract), 614.
 Stomach, carcinoma of, Early diagnosis of, L. G. Rigler (abstract), 998.
 Stomach, early cancer of, Radiological signs of, A. Salotti (abstract), 86.
 [Stomach] Gastric syphilis: observations based on 93 cases, G. B. Eusterman (abstract), 789.
 [Stomach] Gastric syphilis, Roentgen diagnosis of, L. T. LeWald (abstract), 788.
 [Stomach] Gastro-jejuno-colic fistula, with barium enema entering esophagus, C. G. Lyons (abstract), 997.
 [Stomach] Intra-gastric photography, Diagnosis of gastric lesions by: preliminary report, R. Finckelstein (abstract), 620.
 Stomach, Multiple adenopapillomata of, with report of case showing varying degrees of malignancy, F. D. Ackman (abstract), 103.
 Stomach, neurofibroma of: three cases of neuroma: circoid neuroma of face; posterior tibial neurofibroma, J. T. Case (abstract), 834.

- Stomach, Sarcoma of: report of four cases and review of literature, R. D'Aunoy and A. Zoeller (abstract), 830.
- Stomach, Syphilis of, L. L. Hill, Jr. (abstract), 789.
- Stomach, syphilis of, hypertrophic, Clinical diagnosis of, H. Baumecker (abstract), 619.
- Stomach, Syphilis of: study of 8 cases, J. B. Fitts (abstract), 616.
- Stomach, upper portion of, Lower esophagus and, as seen by roentgenologic examination, J. Palugyay (abstract), 996.
- Stone, Robert S., 59.
- Stone, T. T., 713.
- Stone (cited), 585.
- Stoneburner, C. F., 904.
- Stoney, Florence, 400.
- Stout, M. E., 929.
- Strandberg, O., 741, 743.
- Strassmann (cited by E. Zweifel), 585.
- Strauss, Alfred A., 625.
- Strauss, Herman A., 802.
- Structure investigation of silver permanganate, W. Büsser and K. Herrmann (abstract), 597.
- Structure of silicates, W. L. Bragg (abstract), 597.
- Structure produced by rolling of metals, E. Schmid and G. Wassermann (abstract), 593.
- Stubenbord, J. G., 687, 693.
- Stygall, James H., 603.
- Sugden, Frank, 835.
- Sulpharsphenamine, warts treated with, 344.
- "Sulphur granules," 418.
- Sulphuric acid, effects of swallowing, 97.
- Sunlight and Vitamin D, A. v. Wijk, E. H. Reerink, and W. Mörikofer (abstract), 547.
- Surgery, radium, Present status of, H.-G. Zwerg (abstract), 808.
- Sutherland, Charles G., 94, 99, 100, 103, 460, 582, 583, 589, 600, 605-607, 609, 610, 613, 620-626, 786, 789, 790, 791, 794, 805, 815, 819, 820, 824-826, 828, 835, 838, 840, 973, 975, 977-979, 980-984, 988-990, 992, 994, 995, 997, 1000, 1001, 1005, 1008, 1011, 1012, 1019, 1024, 1025.
- Sutton, Don C., 426.
- Sutton, Richard L., 344, 345.
- Sváb, Václav, 997.
- Swan-Myers Company, 74.
- Swart, Howard A., 577, 742, 743.
- Sweet, William M., 612.
- Sweetser, Theodore, 1006.
- Swett, Paul P., 242.
- (Swick method): Intravenous urography, L. Jaches (abstract), 791.
- Swick, Moses, 108, 791, 793, 972.
- Swift, Walker E., 925.
- Swiss army, X-ray examination of called-up men and recruits in, H. E. Walther (abstract), 368.
- Sylla, Adolf, 607.
- Symphysis pubis in roentgen examination of sacroiliac joint, W. E. Chamberlain (abstract), 575.
- Synovial adhesions, Roentgen diagnosis of (abstract), 608.
- Syphilis, Congenital, of bone: case report, L. R. Lingeman, 953.
- Syphilis, Gastric: observations based upon on 93 cases, G. B. Eusterman (abstract), 789.
- Syphilis, gastric, Roentgen diagnosis of, L. T. LeWald (abstract), 788.
- Syphilis in infancy and early childhood, Roentgenological manifestations of, J. E. Heatley (abstract), 401.
- Syphilis of aorta and heart: clinical study, S. S. Riven and J. Reigenbaum (abstract), 1010.
- Syphilis of lungs, K. Herman (abstract), 599.
- Syphilis of stomach, L. L. Hill, Jr. (abstract), 789.
- Syphilis of stomach, hypertrophic, Clinical diagnosis of, H. Baumecker (abstract), 619.
- Syphilis of stomach: study of 8 cases, J. B. Fitts (abstract), 616.
- Syphilis, osseous, congenital, I.—Roentgenographic and pathologic aspects of, S. McLean (abstract), 984.
- Syphilis, osseous, congenital, II.—Correlation of roentgenographic and pathologic aspects of, with particular reference to first months of life, S. McLean (abstract), 984.
- [Syphilis] Syphilitic fetus, Peculiar alterations of ossifying nuclei of, L. De Vecchi (abstract), 400.
- Szymanowski, Wacław T., 710, 718.
- [Tabes] Tabetic arthropathies, A. Steindler (abstract), 983.
- Tabes dorsalis, Peptic and duodenal ulcer in, E. L. Hunt and J. R. Lisa (abstract), 997.
- Tabes, Roentgen therapy of, C. Kremser (abstract), 814.
- Taddei, Domenico, 929.
- Taft, Robert B., 558-560, 990.
- Taft, Robert B., Fluoroscopic-radiographic change switch, 558. *See other reference.*
- Taft, William Howard, 959.
- Tagliovacche (cited by W. W. Belden), 929.
- Talagala, etiology of so-called, Contribution to, J. Odessky (abstract), 576.
- Talbot, J. E., 336, 339.
- Talia, Ferdinando, 577, 973, 1026.
- Tamini (cited by W. W. Belden), 929.
- Tandler, —, 76.
- Tanner (cited by M. C. Borman), 793.
- Tartagli, Dino, 104.
- Taussig, Laurence R., 341, 345.
- Taussig (cited), 585.
- Taylor, Ewing, 645.
- Taylor, Lauriston S., 1-13, 302-321, 893-904.
- Taylor, Lauriston S., Absorption measurements of X-ray general radiation, 302. *See other references.*
- Taylor, Lauriston S., Apparatus for measurement of high constant or rippled voltages, 893. *See other references.*
- Taylor, Lauriston S., Recent progress in X-ray standardization, 1-13. *See other references.*
- Tchirkin, Nikolas, 929.
- [Teeth] Dental radiology in most common applications, S. Parenti (abstract), 993.
- Teeth, X-ray negative, E. S. Best (abstract), 992.
- Temperature, Constant, for X-ray developing, W. L. Holladay, 346.
- Teperson, Hyman I., Anencephaly: the importance of pre-natal diagnosis, with report of case, 334.
- Terrill, H. M., 509, 513, 894.
- Terzani, A., 929.
- Teschendorf, Hans J., 622.
- Teschendorf, W., 792.
- Testicular seminomas and their treatment by means of roentgen rays, J. B. Porchovnik and G. N. Treister (abstract), 415.
- Thaler, Hans, 936, 940.
- Therapy, superficial, Sources of danger in, D. v. Kémeri, 491.
- Thibaud, J., 512.
- Thienes, Clinton H., 75.
- Thilenius (cited), 1029.
- Thom, Bruno, 786.
- Thomas (cited by M. J. Geyman), 482.
- Thompson, George T., Lesions of upper femur, 278.
- Thompson, J. E., 643.
- Thompson, J. Williams, 102.
- Thompson, O. R., 335, 338.

- Thompson (cited by C. F. Geschickter), 133.
 Thomsen, Einar, 798.
 Thomson (cited by M. C. Borman), 793.
 Thorax, diseases of, Limitations of roentgenologic diagnosis of, E. Lachmann (abstract), 603.
 Thorax, Roentgenological appearance of interlobar and mediastinal encapsulated effusion in, Eugene Freedman, 14-29.
 Thoyer-Rozat (cited by W. W. Belden), 925.
 Thrombophlebitis, Radiation therapy of, J. Halban (abstract), 811.
 Thymus, D. D. Martin (abstract), 822.
 Thymus, carcinoma of, with extensive metastases, in new-born child, Case of, G. V. Bedford (abstract), 582.
 Thymus, enlarged, and its treatment, Roentgenology of thymus in infancy and differential diagnoses of, H. K. Pancoast (abstract), 821.
 Thymus gland, Possible significance of, in syndrome of hyperthyroidism, H. M. Margolis (abstract), 1026.
 Thymus, Hyperplasia of: study of 1,045 patients including available family and maternal history, S. W. Donaldson (abstract), 430.
 Thymus in early infancy, Some observations on, E. H. Shannon (abstract), 429.
 Thymus in newborn, Enlargement of, J. A. Johnston and P. J. Howard (abstract), 1028.
 Thymus problem to date, based on study of 475 mediastinal radiographs, J. H. West (abstract), 1027.
 Thymus, Pathological, in children from a roentgenological standpoint, W. H. Gilmore (abstract), 1027.
 Thymus, Roentgen diagnosis and treatment of enlargement of, E. P. Pendergrass (abstract), 821.
 [Thymus] Thymic disorders: Their recognition and treatment, with report of sixteen cases, R. E. Pray (abstract), 1027.
 [Thymus] Thymic shadows in new-born, Incidence of widened, J. V. Grenebaum and L. S. Friedman (abstract), 429.
 [Thymus] Thymic shadows of new-born infants, H. B. Podlasky and S. E. Kohn (abstract), 430.
 Thyroid and parathyroid glands, Effect of X-ray on, O. M. Walters, B. J. Anson, and A. C. Ivy, 52-58.
 Thyroid gland, diseases of, Special points in treatment of, C. C. Higgins (abstract), 431.
 Thyroid gland, diseases of, Value and place of radium in treatment of, S. Ginsburg (abstract), 1028.
 Thyroid gland, Malignant tumors of, C. Williams (abstract), 432.
 Thyroid intoxication, Problem of, R. R. Graham (abstract), 1029.
 Thyssen, Stephen, joint-author, 746.
 Tidmarsh, C. J., 402.
 Tietze, Alexander, 684, 686.
 Tissue, connective, calcium in, Unusual deposition of, M. Cohn and Freye (abstract), 417.
 Titus, Norman E., 729.
 Todd, T. Wingate, 965.
 Tolan, T. L., 553.
 Tongue, cancer of, Radium and surgery in, D. Quick (abstract), 592.
 Tongue, cancer of, Radium treatment of (symposium), S. Cade (abstract), 587.
 Tongue, cancer of, Radium treatment of, S. Cade (abstract), 591.
 Tongue, carcinoma of, Treatment of, M. Friedman (abstract), 587.
 Tongue, Diseases of, H. C. Lindsay (abstract), 90.
 Tongue, Hairy, following adjacent radiation, M. T. Van Studdiford (abstract), 808.
 Tongue, lip, and skin, Cancer of: Ministry of Health report, J. Lane-Clayton (abstract), 987.
 Tonsils, Treatment of diseases of, with roentgen rays, J. Grünthal (abstract), 1020.
 Toyama, Ikuzo, 704.
 [Trachea] Intratracheal injection of iodized oil, Technic of, J. R. Head (abstract), 95.
 Trachea, Roentgen examination in diseases of, Max Sgalitzer (abstract), 428.
 Traumatism, Birth, as factor in urinary infection, F. S. Patch (abstract), 107.
 Trawick, John D., 242.
 Treister, G. N., 415.
 Trendel (cited by C. F. Geschickter), 127, 166, 179.
 Trèves, André, 929.
 Trocmé, P., 28.
 Trostler, I. S., 463, 564, 845, 949, 965.
 Trostler, I. S., Obscure bone case, 949. *See other references.*
 Trotter, Wilfred, 481, 482.
 Trudeau Sanatorium, 600, 1031.
 Truesdale, P. E., 485.
 Tschudi, E., 457, 459.
 Tubes, cathode-ray, Contribution to biological effects of modern, W. Schaefer and E. Witte (abstract), 973.
 Tubes, Lilienfeld-Roentgen, 780.
 Tube, low voltage, Concerning a source of error in calibrating a Müller, L. Böhmer (abstract), 805.
 Tubes, X-ray, 299-301, 353-358, 571, 575.
 Tuberculosis, Analysis of lymphadenopathy question, with special reference to Hodgkin's disease and, F. W. Stewart and C. A. Doan (abstract), 803.
 Tuberculosis, childhood, Important factors in study of, S. Pritchard (abstract), 822.
 Tuberculosis, Childhood type of, E. F. Johnson (abstract), 825.
 Tuberculosis, Differential diagnosis of first stages, of, H. Steininger (abstract), 823.
 [Tuberculosis] Etiology of erythema nodosum in children: Its relation to early tuberculous infection, L. B. Dickey (abstract), 1029.
 Tuberculosis, Hyperplastic, of duodenum and terminal ileum, J. D. Garvin (abstract), 825.
 Tuberculosis, ileocecal, early, Diagnosis of: preliminary report, with special reference to double contrast enema, J. Gershon-Cohen (abstract), 432.
 Tuberculosis in children, H. D. Chadwick (abstract), 433.
 Tuberculosis, laryngeal, Radiographic aspects of, L. Feci and L. Pietrantoni (abstract), 823.
 Tuberculosis of adnexa, roentgen therapy in, Further experience with, H. Eymers (abstract), 417.
 Tuberculosis of genital tract, Diagnosis and treatment of, J. D. Barney, J. L. Watson, and S. Elliott (abstract), 796.
 Tuberculosis of intestine: Its differential diagnosis, J. A. Barga (abstract), 824.
 Tuberculosis of kidney, Roentgenologic diagnosis in, B. H. Nichols (abstract), 794.
 Tuberculosis of knee joint, demonstrated by oxygen injection into joint, B. Ulrichs (abstract), 433.
 Tuberculosis of lungs, Present status and importance of, H. Schulte-Tiggens (abstract), 826.
 Tuberculosis of male genital organs, Contribution to roentgen treatment of, J. Grünthal (abstract), 1017.
 Tuberculosis of suprarenals, Roentgenologic diagnosis of, R. Schatzki (abstract), 825.
 Tuberculosis, pulmonary and secondary intestinal: corrective study, E. H. Rubin (abstract), 434.

- Tuberculosis, pulmonary, Differential diagnosis of, lung abscess and bronchiectasis, F. P. McNamara (abstract), 823.
- Tuberculosis, pulmonary, Early roentgen diagnosis of, L. J. Menville (abstract), 825.
- Tuberculosis, pulmonary, in infants and children, Roentgen diagnosis of, R. G. Karshner (abstract), 433.
- Tuberculosis patients without means, Sun and occupational therapy for surgical, A. Rollier (abstract), 826.
- Tuberculosis, pulmonary, Limitations of heliotherapy in, B. L. Wyatt (abstract), 826.
- Tuberculosis, pulmonary, Non-apical infiltrations in, K. Fischel (abstract), 1030.
- Tuberculosis, pulmonary, Phrenic nerve operations in: Results in five hundred cases, E. J. O'Brien (abstract), 826.
- Tuberculosis, pulmonary, Pork bone in bronchus simulating, C. D. Sneller (abstract), 988.
- Tuberculosis, pulmonary, Subacute and chronic pulmonary infections commonly mistaken for, H. J. Morgan (abstract), 600.
- Tuberculosis, pulmonary, Value of roentgenologic examination in, H. L. Sampson and L. Brown (abstract), 1030.
- Tuberculosis, renal, Intravenous urography in diagnosis of: Case report, T. Sweetser (abstract), 1006.
- Tuberculosis, Suspected juvenile: Evaluation of clinical symptoms and signs, F. Ebersson, J. P. Delprat, and E. Wolff (abstract), 824.
- [Tuberculosis] Tuberculous diseases, surgical, Results of roentgenotherapy of, J. Palugyay (abstract), 1022.
- [Tuberculosis] Tuberculous infection of school children, Significance of advanced, E. L. Opie (abstract), 823.
- [Tuberculosis] Tuberculous lobitis, Clinical and radiologic observations on, P. C. Malugani (abstract), 822.
- [Tuberculosis] Tuberculous spondylitis: Its clinical symptoms and curative results following sunlight and fresh air treatment, E. Kisch and H. Berger (abstract), 827.
- Tuberculosis, urinary, Uroselectan in, O. S. Lowstley (abstract), 1008.
- Tuffier (cited by W. W. Belden), 929
- Tumors, annular, 255.
- Tumors, asymmetric, 255.
- Tumors of ano-rectal region occurring in one person, Three primary malignant epithelial, D. M. Angevine (abstract), 830.
- Tumor, benign giant-cell, 152-157.
- Tumors, benign, of stomach and intestines, Differential diagnosis of, F. Schmitz (abstract), 788.
- Tumors, bone, among ex-service men, Study of, P. B. Matz, 664.
- Tumors, bone, primary, of extremities, Pathological fractures in, B. L. Coley and G. S. Sharp (abstract), 581.
- Tumors, bone, Roentgenologic diagnosis of, C. F. Geschickter, 111-180.
- Tumors, bone, Treatment of, E. I. Bartlett (abstract), 985.
- Tumor, brain, roentgen treatment of, Further experience with, K. Backmund (abstract), 414.
- Tumors, Central, of lower jaw, Richard F. C. Kegel, 216.
- Tumors, endometrial, of ovary and peritoneum, Temporary amenorrhea in treatment of, H. Albrecht (abstract), 109.
- Tumors, Ewing's, 985.
- Tumors, external, 255.
- Tumors, extra-renal, Changes in kidney pelvis on roentgen film caused by, R. Bachrach and K. Hitzengerger (abstract), 828.
- [Tumors] Fibromas of nasopharynx, X-ray treatment of, M. Lambranzi (abstract), 1018.
- Tumors, giant-cell, 183, 213, 220, 237, 250.
- Tumors, Giant-cell: four cases successfully treated by roentgen rays, L. T. LeWald (abstract), 84.
- Tumor, giant-cell, of lower right radius, Case of recurrent, J. Shelton Horsley, 756.
- Tumor, Giant-celled, of upper jaw, H. W. Coates (abstract), 827.
- [Tumor] Hypernephroma with virilism in a child of three years, G. W. Harris and D. F. Plewes (abstract), 830.
- Tumors, Intrathoracic, extra-pleural granulation, O. Dyes (abstract), 832.
- Tumor involving lymphoid tissue, D. S. Childs, 59-64.
- Tumors involving spinal cord, Diagnosis of, H. W. Woltman (abstract), 827.
- Tumors, jejuno-ileum, 259.
- [Tumor] Lipoma of mediastinum, W. M. Yater and E. S. Lyddane (abstract), 829.
- Tumors, malignant, Deposit of active bismuth in, H. Kahn (abstract), 829.
- Tumors, malignant, Irradiation therapy of, in Sweden, G. Forssell (abstract), 833.
- Tumor, Malignant, of ethmoid, J. E. Habbe, 548.
- Tumors, Malignant, of thyroid gland, C. Williams (abstract), 432.
- Tumors, metastatic, 185.
- [Tumor] Multiple myeloma as a single lesion, C. F. Geschickter (abstract), 828.
- [Tumors] Multiple myeloma: Report of case, L. Bryan and J. Levitin (abstract), 831.
- [Tumor] Mycetoma, Maduromycotic (Madura foot): report of case occurring in American negro, J. W. Jones and H. S. Alden (abstract), 979, 980.
- [Tumors] Neuroma, Three cases of: Cirroid neuroma of face; neurofibroma of stomach; posterior tibial neurofibroma, J. T. Case (abstract), 834.
- Tumors of bone, Giant-cell—clinical, histological, and radiotherapeutic study, H. Lacharité (abstract), 84.
- Tumors of colon and non-recognized invagination of tumor, Forcing demonstration of canalization in, A. W. Fischer (abstract), 830.
- Tumors, of intestine, small: their diagnosis, with special reference to the X-ray appearance, Theodore S. Raiford, 253.
- Tumors of os calcis, John R. Moore, 232.
- Tumors of parotid gland, E. B. Benedice and J. V. Meigs (abstract), 831.
- Tumors of pituitary body, Radiological diagnosis and radiation therapy of, Q. Vischia (abstract), 829.
- [Tumor] Periosteal lipoma: Report of two cases, E. I. Bartlett (abstract), 829.
- [Tumor] Perithelioma of fascial origin with direct antecedent history of trauma, Case of, T. V. Cooper (abstract), 827.
- Tumor, Reaction to irradiation as means of differentiating certain varieties of, A. U. Desjardins (abstract), 831.
- [Tumor] Sarcoma botryoides corporis uteri, Case of, P. J. Kearns (abstract), 829.
- Turano, Luigi, 104.
- Turini, G., 929.
- Turner, Henry, 929.
- Turner, H. M. S., 719.
- Turrell, W. J., 836.

- Tuve, M. A., 1015.
 Tyler, Albert F., 729.
- Ude, Walter H., 73, 739, 743.
 Uebel, Paul, 801.
 Uhlmann, Erich, 421, 422, 704, 732, 736, 797.
 Ulcer, duodenal, Radiological diagnosis of, A. Anzillotti (abstract), 98.
 Ulcer, duodenal, Radiological diagnosis of, P. Buisson, M. Bermond, and M. Buisson (abstract), 617.
 Ulcer, duodenal, Subtotal gastrectomy for: ten years' experience and clinical end-results, A. A. Strauss, L. Bloch, J. C. Friedman, J. Meyer, and M. L. Parker (abstract), 625.
 Ulcer, duodenal, X-ray examination in, Evaluation of, C. D. Enfield (abstract), 101.
 Ulcers, Gastric and duodenal, L. O. Nordstrom (abstract), 615.
 Ulcers, gastric and duodenal, perforated Incidence of hemorrhage in, M. Behrend (abstract), 621.
 Ulcer, gastric, chronic, Diet in (abstract), 622.
 Ulcer, Gastric, with gastritis in 10-year-old child, F. Herz (abstract), 620.
 Ulcer, gastroduodenal, and cancer of stomach, Great gastric retention and dilatation of stomach in cases of, T. Klason (abstract), 614.
 Ulcer of extra-bulbar portion of duodenum, Contribution to knowledge of, R. Viviani (abstract), 615.
 Ulcer, Peptic and duodenal, in tabes dorsalis, E. L. Hunt and J. R. Lisa (abstract), 997.
 Ulcers, Peptic: diagnosis and treatment, P. K. Brown (abstract), 615.
 Ulcer, Peptic: diagnostic value of roentgen ray before and after treatment, E. S. Emery, Jr., and R. T. Monroe (abstract), 787.
 Ulcer, peptic, medical treatment of, Results of, R. C. Brown (abstract), 625.
 Ulcer, peptic, Treatment of, with gastric mucin: Preliminary report, S. J. Fogelson (abstract), 1001.
 Ullmann, Henry J., 301, 365-368, 376, 706, 718, 719, 743, 744, 827, 837, 892, 1014, 1019.
 Ullmann, Henry J., What should be done about cancer? 365-368, 376. *See other references.*
 Ulrey, C. T., 304, 894.
 Ulrichs, B., 433.
 Ultra-violet light, Cutaneous papillomata in rat following exposure to, G. M. Findlay (abstract), 836.
 [Ultra-violet light] Dermatologic therapeutics: basic principles and technic, M. Scholtz (abstract), 421.
 Ultra-violet dosimeter, Principles of new, E. Weyde (abstract), 837.
 Ultra-violet light (Osram-Vitalux-Lamp) in diseases of respiratory system, Use of, A. Moeller (abstract), 834.
 Ultra-violet light in treatment of dull and backward child, F. Sugden (abstract), 835.
 Ultra-violet light, Irradiation of body cavities by, generated in them, S. Westmann (abstract), 839.
 [Ultra-violet light] Vitalux lamp, Erythema tests with, S. Epstein (abstract), 836.
 Ultra-violet of sun, On, C. Fabry and H. Buisson (abstract), 835.
 Ultra-violet radiation, Biologic test of, emitted by Vitalux lamp, L. Böhmer (abstract), 838.
 Ultra-violet radiation, Dosage of, in infants with tetany, H. Bakwin and R. M. Bakwin (abstract), 834.
 Ultra-violet radiation on tissue cultures, Effect of, E. Mayer (abstract), 836.
 Ultra-violet rays, Action of roentgen and, on reticulohistiocytic system of skin, P. G. Castellino (abstract), 817.
 Ultra-violet rays, Clinical applications of, John S. Coulter and Edwin M. Smith, Jr., 737.
 Ultra-violet rays on eye, Effect of visible light, infrared and, W. Hoffmann (abstract), 836.
 Ultra-violet rays, Osteitis deformans: Its treatment by, C. Nicory (abstract), 835.
 Ultra-violet rays, short, Intensities of, in sun spectrum, F. W. P. Götz (abstract), 835.
 Ultra-violet, similar effect of, and of roentgen rays, Case of, K. Brummer (abstract), 835.
 Ultra-violet therapy, Symposium on (abstract), 836.
 Umbrathor, Roentgenologic demonstration of mucosa by means of; contribution to roentgenologic diagnosis of ulcerative colitis, H. Regelsberger (abstract), 95.
 Unger, L., 742, 743.
 Upson, W. O., and MacGregor, A. E., Roentgenological aspect of various types of colonic diverticula, 30-38.
 Uranium-thorium colloid in treatment of carcinoma, G. T. Pack and F. W. Stewart (abstract), 591.
 Ureter, carcinoma of, Primary, H. J. Lindner, R. D'Aunoy, and R. J. Mailher (abstract), 583.
 Ureters, double, Interpretation of, L. P. Wershub, (abstract), 792.
 Urethra, female, Roentgen examination of, specially in cases of prolapse and incontinence, E. Thomson (abstract), 798.
 Urinary apparatus, morphologically and functionally normal, Intravenous demonstration of, J. Palugay (abstract), 107.
 Urinary bladder in women, Diverticula of: report of cases, J. J. Crane (abstract), 105.
 Urinary ducts, Examination of, with new substance intravenously injected, D. Tartagli (abstract), 104.
 Urinary infection, Birth traumatism as factor in, F. S. Patch (abstract), 107.
 Urinary tract, Roentgenologic studies of, with contrast agents administered intravenously: Diagnosis in urology, R. E. Cumming (abstract), 1007.
 Urinary tract, Technic of roentgenologic demonstration of, with abrodil, J. Becker (abstract), 1003.
 Urinary tuberculosis, Uroselectan in, O. S. Lowsley (abstract), 1008.
 Urine, Nitrogen excretion in, following roentgen and radium treatment, G. K. F. Schultze (abstract), 420.
 Urographic medium, New: Emulsified campidol (an iodized rapeseed oil), A. A. Kutzmann (abstract), 791.
 Urography, Excretion, with abrodil (skioidan), G. Woytek (abstract), 1006.
 Urography, Intravenous, W. F. Braasch (abstract), 108, 1005.
 Urography, Intravenous, F. H. Colby (abstract), 104.
 Urography, Intravenous, H. L. Kretschmer (abstract), 106.
 Urography, Intravenous, J. S. Read and F. L. Senger (abstract), 107.
 Urography, Intravenous, by means of the sodium salt of 5-iodo-2-pyridon-n-acetic acid, M. Swick (abstract), 793.
 Urography, Intravenous, in diagnosis of renal tuberculosis: Case report, T. Sweetser (abstract), 1006.
 Urography, Intravenous, in diagnosis of urological diseases of childhood, A. Hyman (abstract), 105.

- Urography, intravenous, Principles of, A. von Lichtenberg (abstract), 1001.
- Urography, Intravenous (Swick method), L. Jaches (abstract), 791.
- Urography, intravenous, Uroselectan in, J. Welfeld and D. H. Pardoll (abstract), 104.
- Urography, Intravenous, with uroselectan, J. Duff (abstract), 795.
- Urography, Uroselectan, M. Weinberg (abstract), 796.
- Urologic conditions, Roentgen-ray diagnosis of, H. K. Wade and H. C. Chenault (abstract), 793.
- Urological diagnosis, Value and limitations of uroselectan as aid in, H. G. Bugbee and A. J. Murphy (abstract), 1003.
- Urological diseases of childhood, Intravenous urography in diagnosis of, A. Hyman (abstract), 105.
- Urology, Diagnosis in: Roentgenologic studies of urinary tract with contrast agents administered intravenously, R. E. Cumming (abstract), 1007.
- Uroselectan, 972.
- Uroselectan: Reactions accompanying its practical application: Report of cases, G. W. Hartman (abstract), 795.
- Uroselectan, roentgenologic demonstration of kidneys and urinary passages by intravenous injection of, Concerning, K. Hutter and M. Sgalitzer (abstract), 106.
- Uroselectan urography, M. Weinberg (abstract), 796.
- Uslenghi, Jose P., 929.
- Uspensky (cited by M. J. Geyman), 485.
- Uterine diseases, Radium and its use in, W. E. Gary (abstract), 808.
- Uterosalphingography in general practice: with case reports, J. M. Johnson (abstract), 609.
- Uterus, adenocarcinoma of, Results of radiotherapy in, A. Lacassagne (abstract), 88.
- Uterus, cancer of, Organization and efficiency in fight against, Cl. Regaud (abstract), 85.
- Uterus, carcinoma of body of, Treatment of, W. Neill, Jr. (abstract), 590.
- Uterus, carcinoma of, Systemic changes in patients with, following roentgen and radium treatment, E. O. Gaessler (abstract), 89.
- [Uterus] Cervix, cancer of, Pelvic irradiation in, P. Findley (abstract), 987.
- [Uterus] Cervix uteri, Carcinoma of, C. O. Bailey (abstract), 588.
- [Uterus] Cervix uteri, carcinoma of, Present status of treatment of, E. Zweifel (abstract), 584.
- Uterus, Malignancy of body of, O. L. Norsworthy (abstract), 590.
- [Uterus] Microbial flora of carcinoma of cervix and their importance in radiotherapy, Study of, R. Vinzent and O. Monod (abstract), 89.
- [Uterus] Radium application limited to fundus uteri, G. Kaboth (abstract), 408.
- Uterus, sarcoma of, treated by irradiation, Few cases of, C. Regaud and A. Lacassagne (abstract), 832.
- [Uterus] Uteri, Case of sarcoma botryoides corporis, P. J. Kearns (abstract), 829.
- [Uterus] Uterine cervix and breast, cancer of, Treatment of, by radium and deep therapy X-ray, with 7-, 5-, and 3-year end-results, B. Hunt (abstract), 987.
- [Uterus] Uterine cervix, carcinoma of, Rational treatment of, W. Long (abstract), 987.
- [Uterus] Uterine cervix, Radiotherapy of carcinoma of, at Radium Institute of Paris, A. Lacassagne (abstract), 88.
- [Uterus] Uterine fibroids: analysis of 1,000 consecutive cases, J. Cohen (abstract), 402.
- [Uterus] Uterine fibroids, Further report on X-ray treatment of menorrhagia of menopause and, L. J. Carter, 44-46.
- [Uterus] Uterine hemorrhage, irregular, Radium in treatment of menorrhagia and, M. Donaldson (abstract), 408.
- [Uterus] Uterine sarcoma and roentgen therapy, A. B  cl  re (abstract), 417.
- Uroselectan as aid in urological diagnosis, Value and limitations of, H. G. Bugbee and A. J. Murphy (abstract), 1003.
- Uroselectan as medium for vesiculographic study: preliminary report, E. G. Mark, 933.
- Uroselectan, Comparative value of, to cystographic pyelography, R. H. Herbst (abstract), 1004.
- [Uroselectan] Examination of urinary ducts, with new substance intravenously injected, D. Tagli (abstract), 104.
- Uroselectan, Fatal result from use of, J. A. and F. A. Riebel, 380.
- Uroselectan for intravenous pyelography, J. C. McClelland (abstract), 1006.
- Uroselectan in demonstration of blood vessels (vasography) and especially of varicosities, M. Ratschow (abstract), 609.
- Uroselectan in intravenous urography, J. Welfeld and D. H. Pardoll (abstract), 104.
- Uroselectan in renal lithiasis, Value of, W. F. Braasch (abstract), 1004.
- Uroselectan in urinary tuberculosis, O. S. Lowsley (abstract), 1008.
- Uroselectan, injection of, Pyelographic image after, L. Turano (abstract), 104.
- [Uroselectan] Intravenous demonstration of morphologically and functionally normal urinary apparatus, J. Palugay (abstract), 107.
- [Uroselectan] Intravenous pyelography, A. Laroche (abstract), 108.
- [Uroselectan] Intravenous urography, F. H. Colby (abstract), 104.
- [Uroselectan] Intravenous urography, H. L. Kretschmer (abstract), 106.
- [Uroselectan] Intravenous urography, J. S. Sturdivant Read and F. L. Senger (abstract), 107.
- [Uroselectan] Intravenous urography in diagnosis of urological diseases of childhood, A. Hyman (abstract), 105.
- Uroselectan, Intravenous urography with, J. Duff (abstract), 795.
- Valade, Cyril K., 415.
- Valenti, Alexander, 331, 333.
- Vallebona, Alessandro, 86, 599, 828.
- Valsalva (cited by M. Sgalitzer), 428.
- Van Allen (cited by H. Brunn and S. Brill), 608.
- van Assen (cited by W. W. Belden), 929.
- van Bouwdijk Bastiaanse, E. S., 929.
- van der Tuuk, J. H., 406.
- Van Dessel, Arthur, 553.
- Van Goidsenhoven, F., 1000.
- Van Husen, Johann, 331, 333.
- Van Neck, M., 929.
- Van Studdiford, M. T., 808.
- Van Zwaluwenburg, James G., 71.
- Vastine, Jacob H., 424, 585, 799, 988, 1015.
- Vaughan, Roger T., 244.
- Vedel, Sim  on, 929.
- Veingart, S. M., 929.
- Velde, Gustav, 93.
- Ventriculography, Indications and contra-indications of encephalography and, E. P. Pendergrass (abstract), 1024.
- Verbrugge, Jean, 480, 482.

- [Vertebrae, cervical] Kippel-Feil disease, A. J. Pytel and S. S. Chaievitch (abstract), 427.
- Vertebrae, cervical, New radiographic method for study of, P. Ottonello (abstract), 427.
- Vertebrae, Differential diagnosis of diseases and post-traumatic changes of, H. Holfelder (abstract), 428.
- Vertebra, Fifth lumbar, roentgenologically demonstrated, W. W. Belden, 905.
- Vertebrae, giant-cell sarcoma of, Management of: Report of case with cure after five years, J. O. Bower, J. H. Clark, and L. Davis (abstract), 833.
- Vertebrae, metastasis to, Roentgen treatment of, and bones of pelvis from carcinoma of breast, E. T. Leddy (abstract), 811.
- Vertebrae, peculiar alterations of, Contribution to study of significance of some, D. Perotti (abstract), 426.
- Vesiculographic study, Uroselectan as medium for (preliminary report), E. G. Mark, 933.
- Viamonte, Manuel, 92.
- Villa, Luigi, 1011.
- Vincent, René, 89.
- Virchow, Rudolf, 660, 663.
- Visceroptosis: clinical significance and treatment, E. L. Bortz (abstract), 624.
- Vischia, Quintino, 95, 829.
- Vitamin D, Sunlight and, A. v. Wijk, E. H. Reerink, and W. Mörkofer (abstract), 547.
- Viviani, Rodolfo, 615.
- Voegtlin, C., 710, 718.
- Vogt, E. C., 423, 1001, 1027.
- Vogt (cited by H. B. Matthews), 799.
- Voltagcs, rippled, Apparatus for measurement of high constant or, Lauriston S. Taylor, 893.
- Voltz (cited by F. Melchart), 1020.
- Volwiler, E. H., 74.
- Voorhoeve, N., 328, 333, 482.
- Vynalek, William J., 1008.
- Waddington, Joseph E. G., 729.
- Wade, H. King, 244, 793.
- Waegner, K., 929.
- Waggoner, R. W., 818.
- Wagner, Aage, 564, 565.
- Wainwright, J. M., 769.
- Wakefield, E. G., 706, 707, 718.
- Waller, A. D., 399.
- Wallgren (cited by L. B. Dickey), 1029.
- Wallhauser (cited by E. M. Hanrahan, Jr.), 404.
- Walters, O. M., Anson, B. J., and Ivy, A. C., Effect of X-rays on thyroid and parathyroid glands, 52.
- Walther, H. E., 368.
- Walton, Henry J., 572.
- Wangensteen, Owen H., 73, 995.
- Wappler (cited by A. L. Soresi), 491.
- Warburg, Otto, 77.
- Warburton, F. W., 304.
- Ward (cited), 585.
- Warfield, C. H., 600.
- Warnekros (cited), 585, 799.
- Warner, Arthur H., joint-author, 39-43.
- Warner, W. P., 601.
- Warren, Stafford L., 696, 745, 814.
- Warthin, A. S., 56, 58, 729, 803.
- Warts, Plantar, C. K. Valade (abstract), 415.
- Warts, Treatment of, Earl D. Osborne and Edwin D. Putnam, 340.
- Washington University, 75.
- Wassermann, G., 593.
- Wasson, W. W., 499.
- Wasson (cited by J. H. West), 1027.
- Waters, Charles A., 266, 785, 923, 933, 935.
- Watkins, W. W., 29, 84, 87, 91, 96, 97, 105, 107, 401-403, 410-412, 415, 416, 418-421, 424-427, 429, 431, 432, 434, 491, 573, 582-584, 587-591, 600-603, 609, 612, 615, 619, 785, 789, 793, 795, 796, 798, 801, 803, 807, 808, 810, 812-815, 818, 821-826, 836, 986-988, 991, 993, 995, 997, 1008, 1013, 1019, 1021, 1023, 1027.
- Watson, Henry D., 563.
- Watson, J. Laxton, 796.
- Weatherwax, J. L., 585, 966.
- Weaver, Clarence E., Intussusception: Case Report, 64.
- Webb, Gerald, 603.
- Webb, Gordon, 37, 38.
- Webb, Roscoe C., 577.
- Weber (cited), 972, 973.
- Weber, Harry M., 73.
- Webster, D. L., 8.
- Webster (cited by L. S. Taylor), 894.
- Wechselmann (cited by M. Haudek and J. D. Camp), 851, 855.
- Wegner, Ernst, 929.
- Weidman (cited by M. T. Van Studdiford), 808.
- Weil, A., 713.
- Weill, René, 929.
- Weinberg, E. David, Pathologic fracture, 282.
- Weinberg, Milton, 796.
- Weinstein, Samuel, 572.
- Weiskotten, H. G., 60.
- Weiss, Theodor, 932.
- Weiss (cited by C. E. Weaver), 64.
- Welch, William W., 629, 653.
- Welfeld, Joseph, 104.
- Weller (cited by E. H. Funk), 581.
- Werber, E. I., 336, 339.
- Werner, Walter I., 606.
- Werner (cited by F. A. Ford), 936, 940.
- Wershuh, Leonard P., 792.
- Werthemann, A., 990, 994.
- West, F., 534.
- West, John H., 1027.
- Westermarck, Nils, 736.
- Westgren (cited by S. B. Hendricks), 597.
- Westinghouse X-ray Co., Inc., 491.
- Westman, C., 929.
- Westmann, Stephan, 839.
- Westphal (cited by A. Steindler), 983.
- Weyde, Edith, 837.
- White, J. Renfrew, 242.
- White, William A., 391.
- White, William Crawford, 986.
- Whitehead (cited by E. M. Hanrahan, Jr.), 404.
- Whitman, Royal, 634, 635, 638, 646, 647.
- Whitman, R. W., 997.
- Whitman, W. G., 1015.
- Whitmore, W. H., 237, 244.
- Wiat, Pierre, 929.
- Widere, S., 929.
- Widmann, Bernard P., 244, 585, 888, 891, 967.
- Wiebel (cited by F. C. Christensen), 50.
- Wieloch, J., 937, 940.
- Wiese, H. W., Gastrojejuno-colic fistulae, 477.
- Wiesener, —, 77.
- Wigger, George, 352.
- v. Wijk, A., 547.
- Wikoff, Helen L., 992.
- Wile, U. J., 340, 345.
- Wilhelm (cited by W. W. Belden), 929.
- Wilhelmy, E., 77.
- Wilke, A., 932.
- Williams, Carrington, 432.
- Williams, John W., 334, 338.
- Williamson (cited F. C. Mann and J. L. Bollman), 619.

- Willis, Theodore A., 929.
Willits, P. W., 335, 338.
Wilmoth, Clifford Lee, 929.
Wilson, C. T. R., 5.
Wilson, John C., 83, 929.
Wilson, J. D., 499, 507.
Wilson, Kenneth, 807.
Wilson, Sidney J., 988.
von Winckel (cited by H. I. Teperson), 334.
Winkler (cited by B. R. Kirklin and S. A. Morton), 328.
Winter (cited by S. Parenti), 993.
Winternitz (cited), 1015.
Wintz, Hermann, 110, 401, 415, 422, 585, 1017, 1021.
Wirth (cited by H. Hirsch), 415.
Witte, E., 973.
Witting, V., 577.
Wittkowsky, Curt, 480, 482, 621.
Woernle, Bernhard, 595.
Wolf, G., 602.
Wolff, Ernst, 824.
Wollenberg (cited), 433, 975, 976.
Woltman, Henry W., 827.
Wood, Francis Carter, 291-301, 437, 546, 583, 692, 697-704, 891.
Wood, Francis Carter, Palliative radiotherapy of malignant growths, 291. *See other references.*
Wood, Francis Carter, and MacKee, George M., Therapy with long wave length X-rays (Grenz rays), 697. *See other references.*
Wood, Franklin G., 601.
Woods, Frederick S., 352.
Wooster, Nora, 783.
Wooster, W., 509, 512, 513.
World War, conditions resulting from, 999.
World War ex-service men, bone tumors among, 664.
Worms (cited by J. R. Moore), 242.
Wounds, electrosurgical, Rate of healing of, as expressed by tensile strength, J. D. Ellis (abstract), 839.
Wounds, healing of, Influence of roentgen rays on, S. Kukase (abstract), 840.
Wounds, Healing of operative, in irradiated tissues, V. Podestà (abstract), 839.
Woytek, Georg, 1006.
Wright, Cecil S., 445, 739.
Wright, Lillie M., 975.
Wright, —, 930.
Wurzberg, University of, women's clinic at, 1923-28, Therapy of fibroids and hemorrhagic metropathy in, P. Uebel (abstract), 801.
Wyatt, Bernard Langdon, 826.
Wyckoff, Ralph W. G., 322, 327.
X-radiation and radium, Immunological and biochemical researches on biological action of, L. Cappelli (abstract), 806.
X-ray absorption frequencies, Influence of chemical state on critical, H. R. Robinson and C. L. Young (abstract), 779.
X-ray, Absorption of, by lithium, K. C. Mazumder (abstract), 594.
X-rays, Absorption of, in gases and vapors (I.—Gases), J. A. Crowther and L. H. H. Orton (abstract), 783.
X-ray absorption spectrum of nickel, copper, and zinc, Contribution to knowledge of K, A. E. Lindh (abstract), 782.
X-ray analysis of copper-manganese alloys, E. Persson (abstract), 781.
X-ray analysis (IV): Polymorphism of sodium sulfate, F. C. Kracek and C. J. Ksanda (abstract), 594.
X-ray and clinical study of bones of hands and feet, An, Max Kahn, 211.
X-ray carcinomas, Multiple, following psoriasis: Case report and comment, H. Goodman and C. W. Price (abstract), 818.
X-ray, dependence on, Our growing (abstract), 602.
X-ray determination of solubility of copper in silver, N. V. Ageev and G. Sachs (abstract), 783.
X-ray developing, Constant temperature for, W. L. Holladay, 346.
X-ray diagnosis, K. D. A. Allen (abstract), 602.
X-ray diffraction in liquid hexamethylbenzene, P. Krishnamurti (abstract), 594.
X-ray diffraction in liquids, Liquid structure and, K. Banerjee (abstract), 594.
X-ray diffraction intensities, Comparison of, with structure factor computations in liquid long chain compounds, Ross D. Spangler, 359.
X-rays, diffuse, reflected from distorted sylvine, Intensity measurements of, R. Brill (abstract), 780.
X-ray dosimeter, Biological calibration of, C. Packard (abstract), 611.
X-ray, Early—early diagnosis, W. B. Davidson (abstract), 603.
X-rays, Effect of, on reticulo-endothelial system of spleen, E. Conte (abstract), 416.
X-rays, effects of, on ovary during period of oögenesis, Histological study on, G. Gricouroff (abstract), 109.
X-ray examination in acute intussusception, E. Edberg (abstract), 617.
X-ray examination, in duodenal ulcer, Evaluation of, C. D. Enfield (abstract), 101.
X-ray examination of appendix, Comments on, J. T. Case (abstract), 974.
X-ray examination of called-up men and recruits in Swiss army, H. E. Walther (abstract), 368.
X-ray films, System of reading, for use in sanatoria, D. McRae (abstract), 599.
X-ray general radiation, Absorption measurements of, L. S. Taylor, 302.
X-rays, gold-copper alloys investigated by means of, K. Oshima and G. Sachs (abstract), 781.
X-ray grating spectra, False lines in, J. M. Cork (abstract), 593.
X-ray in diagnosis of carcinoma of colon, Role of, L. B. Morrison (abstract), 86.
X-rays in diagnosis of terminal bowel disease, Sigmoidoscopy versus, F. C. Yeomans (abstract), 622.
X-ray in low-back injuries, Observations, J. C. Johnston (abstract), 426.
X-rays in pregnancy, Some notes on value of, H. R. Sear (abstract), 1009.
X-rays in stars, A. S. Eddington (abstract), 719.
X-rays in treatment of malignant disease, Place of, with especial reference to cancer of breast, F. Hernaman-Johnson (abstract), 1017.
X-rays, Injuries to gonads not caused by, but due to extraneous factors, H. Stieve (abstract), 405.
X-ray intensity measurements with deformed crystals, J. Hengstenberg and H. Mark (abstract), 779.
X-ray investigation of crystals of azobenzene, M. Prasad (abstract), 779.
X-ray K terms of lighter elements and rare gases from optical potential of ionization, Calculation of, W. Braumbek (abstract), 781.
X-ray, Low voltage, for therapeutic menopause, J. C. Potter (abstract), 798.
X-rays, long wave, Absorption of, of — 10 Å. U. in light elements, B. Worenle (abstract), 595.
X-ray negative teeth, E. S. Best (abstract), 992.

- X-ray means, Determination of inner structure of liquids by, P. Debye and H. Menke (abstract), 780.
- X-ray methods, Determination of degree of polymerization of some modifications of polyoxymethylene by means of, E. Ott (abstract), 782.
- X-rays on thyroid and parathyroid glands, Effect of, O. M. Walters, B. J. Anson, and A. C. Ivy, 52-58.
- X-ray quality measurement, Theory of, M. M. Schwarzschild, 856.
- X-ray reflection from two sides of III plane of zinc blende, Difference in intensities of, D. Coster, K. S. Knol, and J. A. Prins (abstract), 780.
- X-rays, Reflection of, on absorbing ideal crystals, J. A. Prins (abstract), 783.
- X-rays, reflection of, Total, E. Nähring (abstract), 782.
- X-rays, Scattering of, by bound electrons, S. Bhargava (abstract), 595.
- X-rays, secondary, Quantitative spectroscopic analysis with, G. v. Hevesy, J. Böhm, and A. Faessler (abstract), 779.
- X-ray serialograph, Practical, A. I. Arneson (abstract), 572.
- X-rays, short, upon human heart, Far-reaching effects of gamma rays and: Electrocardiographic results of cancer treatments given without direct irradiation of heart. J. E. Gendreau (abstract), 802.
- X-ray spectrograph with absolute zero determination without divided circle and zero method of Cornu, New, H. Seeman (abstract), 780.
- X-ray spectroscopy, Atomic analysis by, T. H. Laby (abstract), 597.
- X-ray standardization, Recent progress in, Taylor, L. S., 1-13.
- X-ray standpoint, Osteochondritis dissecans considered from, G. Jansson (abstract), 578.
- X-ray study of certain esters of cellulose and of glucose, A. Nowakowski (abstract), 593.
- X-ray therapy of Basedow's disease in older women, Our method of, A. Jugenburg (abstract), 432.
- X-ray therapy plant, deep, Nitrogen peroxide from mechanical rectifiers of, R. K. Newman (abstract), 571.
- X-rays, Therapy with long wave length (Grenz rays), Francis Carter Wood and George M. MacKee, 697.
- X-ray treatment, Deep, of chronic gonorrheal infection in female, C. M. Henry, 45-50.
- X-ray treatment, Fluctuations of blood pressure following, and clinical significance, H. Pausdorf and W. Nell (abstract), 574.
- X-ray treatment of Basedow's disease, Causes of success and failure in, P. Hesz and H. Schlecht (abstract), 1029.
- X-ray treatment of bone metastasis, C. B. Rose, 536.
- X-rays, treatment of erysipelas by, with account of three cases, Note on, R. H. Jamieson, and F. Hernaman-Johnson (abstract), 810.
- X-ray treatment of essential hematuria: case report, L. J. Carter, 944.
- X-ray treatment of fibromas of nasopharynx, M. Lambranzi (abstract), 1018.
- X-ray treatment of menorrhagia of menopause and uterine fibroids, Further report on, L. J. Carter, 44-46.
- X-ray treatment of warts, 341 *et seq.*
- X-ray tube in radiography, Focal spot projection and position of, P. M. Andrus and A. Hambleton, 869.
- X-ray tube, "Quality" of, and how to measure it, A. Bouwers, 353.
- X-rays upon retina, Effect of, W. Hoffman (abstract), 1019.
- X-ray visualization of calcified gallstone in child seven years old: case report, H. Rudisill, Jr., 942.
- X-rays. *See under* Roentgen rays, etc.
- Xanthoma, 214.
- Xanthomatosis (Schüller's disease; Christian's syndrome): report of three cases treated with roentgen rays, M. C. Sosman (abstract), 414.
- Yanagizawa, H., 608.
- Yater, Wallace M., 829.
- Yeomans, Frank C., 622.
- Youmans (cited by L. L. Hill, Jr.), 789.
- Young, Antonio D., 425.
- Young, C. L., 779.
- Young, H. E., 47, 51.
- Young, H. H., 933, 935.
- Young (cited by H. C. Bumpus, Jr.), 790.
- Zaccaria, A. A., 929.
- Zacherl (cited by E. Zweifel), 585.
- Zeno, L. O., 929.
- Ziegler, Kurt, 52, 57.
- Ziegler (cited by Krebs, C., Rask-Nielsen, H. C., and Wagner, A.), 565.
- Zimmern, A. Lauret, 929.
- Zoeller, Adelaide, 830.
- Zorraquin (cited by W. W. Belden), 929.
- Zulick, J. D., 58.
- Zuppinger, A., 812.
- Zweifel, Erwin, 584.
- Zwerg, H. G., 808.
- Zwicker, A., 485.

